Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites

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Superfund Division
U.S. Environmental Protection Agency
Region 7
Lenexa, Kansas

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TABLE OF CONTENTS

FIGURE

TABLES

APPENDICES

1.0 INTRODUCTION

This generic Quality Assurance Project Plan (QAPP) for Region 7's Superfund Lead-Contaminated Sites was prepared to specifically address Superfund investigations on former and active mining, milling and smelter facilities and the associated impacted areas from the operations of these facilities. This generic QAPP is a companion QAPP to the Generic Quality Assurance Project Plan for the Superfund Site Assessment and Targeted Brownfield's Assessment Programs, dated October 2012. The QAPP for the Superfund site assessment and targeted brownfield's assessment programs was specific to those programs. This generic QAPP addresses those investigations that are being conducted under the Pre-Remedial (i.e., Site Assessment), Removal and Remedial Programs.

This generic QAPP will assist in the development of site or project specific QAPPs. This should reduce contract costs and promote consistency among all future contractors working on lead site(s). This generic QAPP is a detailed guide for the preparation of site or project specific QAPP, but is not an end all for everything this type of QAPP should and should not contain. A site or project specific QAPP should prescribe the use of specific methods, site specific conditions, and best professional judgment of the site manager.

The Pre-Remedial, Removal and Remedial Programs each have their unique process and ultimate goals in addressing the threat to human health and the environment. The Pre-Remedial Program process is to conduct an initial investigation to determine if threats to the public health and environment actually or potentially exist. During the Pre-Remedial process the human health and ecological threats are identified and a numerical score is obtained to determine the potential for placing the site on the National Priorities List.

The Removal Program process is to conduct investigations to determine if a removal action (i.e., emergency, time-critical or non-time critical) are warranted at a site being investigated. These removal actions can occur during the Pre-Remedial or Remedial phase of the Superfund Process.

The Remedial Program process is to conduct investigations (i.e., Remedial Investigations) for gathering data for the Baseline Risk Assessment for human health and the ecology, and to determine the extent of contamination and to evaluate alternatives for cleanup.

The ultimate success of an environmental data collection effort at Superfund mining, milling and smelter sites contaminated with lead (includes: arsenic, barium, and cadmium) depends on the quality of the data collected and used to make decisions. The QAPP is a critical planning document for investigation activities that requires the collection and/or use of environmental data. Thus, the U.S. Environmental Protection Agency's (EPA) policy requires that all environmental data used in decision-making be supported by an Agency-approved QAPP developed from a systematic planning process. The QAPP documents how environmental data collection operations are planned and implemented and how the results are assessed. In addition, the QAPP defines the specific quality assurance (QA) and quality control (QC) activities that will be applied to ensure that the environmental data collected are of the type and quality needed for a specific decision or use.

Current EPA requirements for QAPPs are detailed in EPA's Quality Manual and in EPA Requirements for Quality Assurance Project Plans EPA QA/R-5 (EPA, 2001a). These documents describe the QAPP as divided into four basic element groups covering project management, data generation and acquisition, assessment and oversight, and data validation and usability activities. Each element group is subsequently divided into elements covering different topics; there are 24 elements (Table 1). Not all elements will pertain to every project. Guidance documents for QAPP preparation are available in Guidance for Quality Assurance Project Plans EPA QA/G-5 (EPA, 2002a) and Guidance on Choosing a Sampling

Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan EPA QA/G-5S (EPA, 2002b).

Table 1 List of QAPP Elements

Group A. Project Management	Group B. Data Generation and Acquisition	Group C. Assessment and Oversight
A1 Title and Approval Sheet	B1 Sampling Process Design (Experimental Design)	C1 Assessments and Response Actions
A2 Table of Contents	B2 Sampling Methods	C2 Reports to Management
A3 Distribution List	B3 Sample Handling and Custody	
A4 Project/Task Organization	B4 Analytical Methods	**Group D. Data Validation and Usability**
A5 Problem Definition and Background	B5 Quality Control	D1 Data Review, Verification, and Validation
A6 Project/Task Description	B6 Instrument/Equipment Testing, Inspection, and Maintenance	D2 Verification and Validation Methods
A7 Quality Objectives and Criteria	B7 Instrument/Equipment Calibration & Frequency	D3 Reconciliation with User Requirements
A8 Special Training/ Certifications	B8 Inspection/Acceptance of Supplies and Consumables	
A9 Documentation and Records	B9 Non-direct Measurements	
	B10 Data Management	

- ***Project Management*** – These elements address the project history and objectives, and the roles and responsibilities of the participants. These elements ensure that the project goals and approach are clearly understood and that project planning is documented. The Group A project management elements are shown in Table 1 and included in Section 2.0 of this document.

- ***Data Generation and Acquisition*** – These elements describe the measurement system design and implementation and document sampling, analysis, data handling, and QC methods that will be used. The Group B data generation and acquisition elements are shown in Table 1 and included in Section 3.0 of this document.

- ***Assessment and Oversight*** – These elements identify activities for assessing the effectiveness of project implementation and the associated quality assurance and quality control efforts. As such, these elements ensure that the QAPP is implemented as approved. The Group C assessment and oversight elements are shown in Table 1 and included in Section 4.0 of this document.

- ***Data Validation and Usability*** – These elements describe quality assurance activities that occur after data collection or generation. These elements ensure that the data collected conforms to stated acceptance criteria and achieves data quality objectives (DQOs). The Group D data validation and usability elements are shown in Table 1 and included in Section 5.0 of this document.

This Generic QAPP has been developed for Region 7's Superfund Program to be specific to Superfund lead-contaminated sites and is organized in accordance with the 24 QAPP elements specified in EPA QA/R-5 (EPA, 2001a).

The intent of this Generic QAPP for Region 7's Superfund lead-contaminated sites is to provide a framework of procedures for all environmental data collection activities that might occur in accomplishing Site Assessment (SA), Integrated Site Assessment (ISA), Removal Site Evaluation (RSE) and Remedial Investigations (RI) activities under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Generic QAPP emphasizes the use of proven, validated, and EPA-approved sampling methods and analytical methods such as those in the EPA Contract Laboratory Program Statements of Work and the Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (EPA Publication SW-846) or region specific methods in the EPA Region 7 Environmental Services Division Operations and Quality Assurance Manual (ESDOQAM) (EPA, 2000a). These and other sampling and analytical methods are identified in appropriate sections of this Generic QAPP and will be followed whenever they are sufficient to meet environmental data collection requirements and DQOs.

Task Order (TO) or Procurement Request (PR) are prepared in-house and issued to EPA's contractors to accomplish SA, ISA, RSE and RI projects. All projects conducted by an EPA contractor will have their own site-specific QAPP Addendum or project-specific QAPP. In most instances, the site-specific QAPP Addendum and the Sampling and Analysis Plan (SAP) requirements for a project will be specified within the sampling activities segment(s) of the project work plan(s) along with completing the **Region 7 Superfund Program Addendum for the Generic QAPP for the Superfund Lead-Contaminated Sites Form** (R7 QAPP Addendum Form) as shown in Appendix A. The work plan, containing the elements of a SAP, will be supplemented with appropriate site and sampling location maps and should include a sample summary table or tables that list the sample type (i.e., media and/or purpose), collection methods, and analytical methods to be utilized. Many of the sampling and analytical standard operating procedures (SOPs) that are described in the Region 7 ESDOQAM will be broadly applicable and can be referenced. Additionally, common procedures such as sample handling, chain of custody, data validation, and corrective action should be included **by reference only**. The completed R7 QAPP Addendum Form will be included in the work plan as an attachment or appendix.

There will occasionally be large-scale and/or special projects or pilot studies that may require a "project-specific QAPP" that is independent of this generic QAPP. The requirement to prepare a project-specific QAPP should be identified in the project scope of work and incorporated into the project work plan. The QAPP should be identified in the project scope of work and incorporated into the project work plan. Project-specific QAPPs will be formatted similar to this generic QAPP. If necessary, describe any modifications to the Region 7 ESDOQAM sampling and analytical methods and/or specify any additional data collection procedures that are required to meet the project-specific objectives. Some of the sampling and analytical SOPs that are described in detail within the Region 7 ESDOQAM may be broadly applicable and can be referenced. To the extent possible, common procedures such as sample handling, chain of custody, data validation, and corrective action should be included **by reference only**.

2.0 PROJECT MANAGEMENT

2.1 Distribution List

Copies of the approved Generic Quality Assurance Project Plan (QAPP) for Region 7's Superfund Lead-Contaminated Sites activities will be distributed to the following individuals:

EPA Region VII:	Gene Gunn, Chief, SPEB Scott Hayes, Chief, ERSB Kenneth S. Buchholz, Chief, ERNB Region 7 National Priority List Coordinator Site Assessment Mangers who perform SA and ISA activities On-Scene Coordinators who perform ISA and RSE activities Remedial Project Manager who perform RI activities Diane Harris, Regional Quality Assurance Manager R7@ Work Local Area Network
Contractor:	Program Manager Quality Assurance Officer (Contractor will distribute copies within their organization)

2.2 Project and Task Organization

Specific responsibilities of the individuals directly involved with the Superfund's Pre-Remedial, Removal and Remedial Programs are outlined below:

2.2.1 EPA Project Managers

The EPA Project Managers (i.e., Site Assessment Managers (SAMs), On-Scene Coordinators (OSCs), and Remedial Project Managers (RPMs) will serve as the project manager for the SA, ISA, RSE and RI activities. The EPA Project Managers will determine project requirements and ensure that the general scope of work necessary to accomplish the project is provided on the project TO or PR form and/or otherwise communicated to the contractors. The EPA Project Managers will help resolve problems and provide details when necessary to help contractor develop and/or select options for the technical approach and methods to be employed for a project and to develop sampling strategies. The EPA Project Managers will review work plans and cost estimates, and make recommendations to their Branch Chief for any approval/modifications. The EPA Project Managers will perform project oversight by conducting document reviews, audits, site visits, or field oversight activities. The EPA Project Managers will also provide periodic updates to EPA management and/or to EPA Region 7 personnel concerning project status/progress as required.

The EPA Project Managers will oversee all elements associated with the project and will coordinate field activities and other site-related operations with the contractor's Project Manager.

2.2.2 EPA Regional Quality Assurance Manager

The EPA Regional Quality Assurance Manager is required to review and approve this Generic QAPP for Region 7's Superfund Lead-Contaminated Sites and provide general guidance and/or specific instructions to ensure that this Generic QAPP is in compliance with EPA guidance documents and policy. Once the Generic QAPP is revised to meet the standard requirements, it can be coordinated for approval by the EPA Regional Quality Assurance Manager or her designated representatives.

2.2.3 EPA Superfund Branch Chiefs and Section Chiefs

The EPA Superfund Branch Chiefs will provide overall program management and are the primary decision makers in cooperation with the EPA Region 7 program and/or Project Managers/coordinators. The Branch Chief or his/her designated representative will provide the contractor with the general project scope and objectives and request contractors provide work plans that include site-specific SAP and site-specific QAPP Addendum or project-specific QAPP. The Branch Chief(s) or an appropriate designee will approve recommendations from EPA Project Managers for project work plans and budgets, direct modifications/revisions if required, and ensure that the proper level of management authorization is obtained to approve the project work plan and associated costs (i.e., the project budget). Copies of TO or PR forms, work plans (including cost proposals and SAPs) will be provided to the appropriate EPA Region 7 personnel upon request.

2.2.4 EPA Superfund Site Assessment Coordinator

The EPA Superfund Site Assessment Coordinator monitors the progress of the site assessment projects as well as provides oversight of the Cooperative Agreements funding those projects under CERCLA authority. The EPA Region 7 Superfund Site Assessment Coordinator will review this Generic QAPP and will coordinate necessary revisions between the appropriate EPA Superfund personnel in order to implement the requirements mandated by the Generic QAPP and other QA/QC policy and guidance documents and/or program initiatives.

2.2.5 Contractor Quality Assurance Manager

The contractor's Quality Assurance Manager (QA) Manager for the site-specific project is responsible for monitoring the quality of technical documents generated by the contractor and its subcontractor. He/she will provide direction and guidance to contractor personnel and, through subcontractor QA/project manager(s), to subcontractor personnel performing activities under the contract. The contractor's QA/project manager will maintain a comprehensive quality program based on this Generic QAPP and will issue recommendations about quality to technical staff and management at the contractor's organization. Specific QA/project manager responsibilities include the following:

- Meeting regularly with the contractor's Contract Administrator to review, discuss, and resolve any quality issues and concerns.
- Reviewing, approving, and/or providing guidance to contractor Project Managers and/or technical staff for developing site-specific QAPP Addendums or project-specific QAPPs.
- Interacting with EPA representatives to evaluate the acceptability and qualifications of laboratory and technical subcontractors.
- Conducting field and laboratory audits, identifying nonconformance situations resulting from audits or other QA/QC review activities and notifying the appropriate EPA personnel, contractor's Project Manager(s), the contractor's Contract Administrator and/or regional office manager, and/or subcontractor personnel.
- Providing recommendations and orders for corrective action for all aspects of work that do not meet program standards.
- Facilitating QA problem identification and resolution at both the project- and contract-levels.
- Managing and overseeing all aspects of laboratory procurement and management, data management, data validation, and document generation and review/revision.

2.2.6 Contractor's Contract Administrator

The contractor's Contract Administrator will serve as the primary EPA point of contact for all contract activities. The contractor's Contract Administrator is ultimately responsible for all field data collection and reporting activities performed in accordance with the QAPP and should ensure that contractor's Project Managers are qualified and provided adequate staff and equipment support to achieve the project requirements. Specific responsibilities of the contractor's Contract Administrator shall include, but may not be limited to the following:

- Receiving, acknowledging, and implementing all TO or PR forms and the resulting approved work plans and other project requirements.
- Designating a Project Manager for each TO or PR.
- Ensuring work plans (including scheduling of work) are submitted for approval by EPA for each TO or PR and for the proper implementation of those approved work plans.
- Providing overall supervision and administrative support to the Projects Manager including providing all the support staff, facilities, administrative capabilities, clerical support and all other resources needed to ensure the successful and efficient accomplishment of TOs or PRs issued and/or project assigned under the contract.
- Reporting and correcting all problems encountered in performing work pursuant to TOs or PRs or in the administration of the contract whether noted by the contractor or noted by representatives of the EPA.
- Preparing and submitting all reports, data, or other deliverables required in the TO or PR forms and ensuring that all deliverables are in compliance with the QA/QC requirements described in the work plan, this Generic QAPP, site-specific QAPP Addendum, or project-specific QAPP documents.

2.2.7 Contractor's Project Managers

The contractor's Project Managers are responsible for implementing all activities identified in the TOs or PRs issued by EPA. The contractor's Project Managers have the authority to commit the resources necessary to meet the technical, financial, and scheduling objectives for the project. The contractor's Project Managers will report directly to the contractor's Contract Administrator and will serve as or provide access information for the major point of contact(s) and control(s) for project-related activities and/or issues. Specific responsibilities of contractor project managers include the following:

- Preparing project work plans with SAP components, site-specific QAPP Addendum or project-specific QAPP for projects involving environmental data collection.
- Verifying that the contractor and/or subcontractor's project team performs contract work and generate contract-related documents and deliverables that comply with all QA requirements in this Generic QAPP and any site-specific QAPP Addendum or project-specific QAPP.
- Monitoring and directing field activities and verifying that appropriate field measurement, field testing, and other field procedures are followed and that appropriate QC checks are conducted.
- Working with the contractor's Quality Assurance Manager and the contractor's Contract Administrator to identify QA problems and to implement effective corrective actions.

On large field investigations the contractor's project manager may be supported by a field team leader (FTL). The FTL is responsible for directing day-to-day field operations and reporting to the contractor's Project Manager on a daily basis. The FTL will monitor field measurement and sampling procedures to

verify the requirements of the work plan documents including site-specific QAPP Addendum or project-specific QAPP are followed. The FTL will also ensure that proper chain-of-custody procedures for sample handling and shipment are utilized. Other specific responsibilities of the FTL include the following:

- Supervising staffing and mobilization activities for field work.
- Overseeing sample collection and field measurements and maintaining field logbook(s).
- Overseeing the activities of all project personnel in the field, including subcontractor personnel.
- Providing the contractor's Project Manager with the required planning, cost and schedule control, records documentation, and data management information related to field activities.
- Facilitating project-level QA/QC problem identification and resolution.

2.2.8 Contractor's Technical Staff

The contractor's technical staff will conduct field activities, gather and analyze data, and prepare various project reports and support materials. The contractor's technical staff will be required to follow procedures and requirements that are specified in TO or PR and approved work plans, QA/QC documents including this Generic QAPP, site-specific QAPP Addendum or project-specific QAPP and other guidance and/or instructions provided by appropriate contractor and/or EPA project/contract management personnel. The contractor's Contract Administrator, with a reasonable amount of assistance from contractor's Project Managers, is responsible for ensuring that all contractor's technical staff members assigned to a project are experienced professionals, who possess the degree of specialization and technical expertise required to effectively and efficiently perform their duties and responsibilities, necessary to complete the required work/task for all TOs or PRs /projects issued under contract.

2.2.9 Team Subcontractor's Project Managers and Staff

Subcontractors may be assigned responsibility for completing all or part of TOs or PRs issued under a contract. On projects with subcontractors having primary involvement, the subcontractor's Project Manager(s) are responsible for the planning, scheduling, budgeting, and reporting related to subcontractor activities. On projects where subcontractors play a supporting role, the subcontractor's Project Manager(s) will coordinate their activities through the prime contractor's Project Manager. Subcontractor's Project Managers will provide technical review of all work conducted by their staff. They will also verify that all work is conducted in compliance with contractor's overall quality requirements and with the quality requirements of any applicable work plans, this Generic QAPP, or site-specific QAPP Addendum or project-specific QAPP.

2.2.10 Team Subcontractor's Quality Assurance Manager

For all portions of the project and data collection activities assigned to the subcontractor component of the team, the team subcontractor's Quality Assurance Manager is responsible for ensuring that all technical services provided by the subcontractor comply with overall EPA contract QA/QC requirements and the project-specific QA requirements of any applicable work plans/SAPs, or site-specific QAPP Addendums or project-specific QAPPs. Specific QA/QC responsibilities of the team subcontractor's Quality Assurance Manager include the following:

- Reviewing and approving work plans/SAPs, site-specific QAPP Addendums or project-specific QAPPs or the applicable segments of such documents under which the subcontractor will provide technical services.

- Monitoring subcontractor performance on the project, including compliance with sample collection, field analysis requirements, sample preparation and analysis methods, sample holding times, required field QC check samples, and data validation as required.
- Maintaining project-specific records of QC data, performance evaluation results, audit comments, and data quality inquiries.
- Applying the subcontractor's QA/QC program to the work done on the project, including reviewing all deliverables before they are submitted to the contractor and verifying that they meet the requirements specified in the project work plan/SAP, or site-specific QAPP Addendum or project-specific QAPP.
- Ensuring that corrective action is implemented when required/directed by appropriate representatives of the prime contractor or appropriate EPA project/contract management personnel.
- Assisting the prime contractor in resolving any QA/QC issues related to the applicable analytical and/or field laboratory's work.
- Facilitating project-level QA/QC problem identification and resolution.

2.3 Problem Definition and Background

This section provides general background information on the contracts EPA utilizes to perform Superfund related work. The Superfund Technical Assistance and Response Team (START) and Application Environment Services (AES) are two such contract mechanisms used in Superfund. In addition, this section outlines information that should be included in the Problem Definition and Background section of any site-specific QAPP Addendum or project-specific QAPP that would be prepared in response to a TO or PR under EPA contracts.

2.3.1 EPA Environmental Services Contract Background

The EPA utilizes contractors to conduct site assessment, removal assessment and remedial investigation work at sites that are either part of, or considered, potential candidates for Superfund program examination. In addition to Superfund site assessment, other functions may be required to achieve project requirements such as groundwater monitoring evaluation/inspections, technical document reviews and data management activities. All Superfund site assessment, removal site evaluation, and remedial investigation projects are done in accordance with the CERCLA/Superfund pre-remedial, removal and remedial processes. In general, the objectives are to evaluate known or suspected releases of hazardous substances to the environment (i.e., soil, surface water, groundwater air), and to identify the possible sources of the release and the potential impact on likely receptors.

The contractor will be required to furnish all personnel, facilities, equipment, materials, and services necessary for the performance of all work described in the contracts. Specific deliverables and due dates will be as specified in each TO or PR.

2.3.2 Project-Specific Problem Definition and Background

Selection of sites for SA, ISA, RSE or RI sampling, scoring and reporting should utilize any previous investigations or screening activities conducted by the States, EPA or their contractors, or based on other available information collected through desktop/record search activities. The major category of sites where sampling will be performed includes, but is not limited to active/former lead mining, milling and smelter sites, areas impacted by mining, milling, and smelter activities, mining depositories, transportation routes from mining, milling and smelter sites and the use of mining wastes in public and residential areas.

2.4 Project and Task Description

This is a Generic QAPP for investigations being conducted on EPA Region 7's Superfund lead-contaminated, or potentially contaminated sites under the pre-remedial, removal and remedial programs in the four-state region by EPA and/or its contractors. EPA expects to maintain contracts with firms that provide a wide range of environmental services and who can obtain other specialty environmental-related contract services. Once a site is selected, one of the EPA contractors will be assigned to the project. The site assignment or detection monitoring/sampling activities will be initiated by preparing a TO or PR. The EPA contractor will prepare a site-specific QAPP Addendum or project-specific QAPP which will contain elements of a SAP or a work plan and these documents must clearly identify the proposed sampling, scoring and reporting requirements. Typically, the QA/QC requirements will be provided in the work plan and referencing procedures in, or otherwise using, this Generic QAPP for guidance. The actual site-specific number, location and type of samples will be described in the work plan and its accompanying QA/QC components. Reference to the EPA Generic QAPP requirements will be incorporated in the SAP along with any site-specific QAPP Addendum or project-specific QAPP that may be developed or utilized.

The general objectives of Superfund's site assessment, integrated site assessment, removal site evaluation and remedial investigation sampling efforts are:

- To identify and sample potential source(s) of contamination and thus demonstrate whether a release of hazardous substance has occurred.
- To sample media (Matrix: soil, sediment, soil/rock, groundwater, surface water, dust/wipes and air) that is directly or indirectly exposed/accessible to potential human and/or ecological receptors/targets that may have been impacted or is potentially threatened.
- To estimate the area of contamination and to determine whether the contamination may be attributed to particular actual/potential source area(s).
- To determine whether any contamination (i.e., arsenic, barium, cadmium, cobalt, copper, lead, nickel and zinc) above Maximum Contaminant Levels (MCLs) or health-based benchmarks/action levels exist that poses a threat to human health or the environment.

Soil and groundwater samples will be collected at potential source areas and along suspected migration pathways using direct push sampling probes or conventional drilling when direct push technology will not be able to reach the desired sampling depths. Sediment and surface water samples may also be collected using conventional sampling procedures. Potential targets such as nearby (generally within a mile) private wells and public water supply wells (systems within four miles) may also be sampled.

Sample analysis can either be conducted either in the field or at a lab. A percentage of field analyses will be verified by laboratory analysis of a percentage of samples. The percentage varies depending on site conditions and current methodologies. Standard Operating Procedures (SOPs) for a particular field analysis technique will provide guidance on the recommended percentage of samples that need to be sent to the lab.

Data collected during the site assessment activities will be used for site scoring and reporting to evaluate whether further regulatory action(s) will be needed at the site or other actual/potential impacted areas off-site. The contractor and/or subcontractors will provide all site assessment sampling supplies and equipment, unless supplied by EPA.

In general, an initial screening of the site will be performed to determine the site's eligibility for response under CERCLA, assess the need for emergency response activities, determine the potential for non-CERCLA response actions, and ascertain the need to obtain additional information pertaining to the site.

If only limited information on site contamination is known, a percentage of samples are typically analyzed for the compounds contained in the Contract Laboratory Program (CLP) Target Analyte List. When information is obtained the analyte list will be tailored to the site. When environmental sampling is planned, a R7 QAPP Addendum Form will be prepared for SA, ISA and RSE activities and will be included in the site-specific QAPP Addendum. This form will be completed in accordance with EPA Region 7 and national program guidance and will encompass the data quality objectives (DQOs) outlined in this Generic QAPP, sampling network design, data collection procedures (including assessment of quality control parameters), special personnel and equipment requirements. The QAPP Form shall be reviewed and approved by the Regional Quality Assurance Manager prior to the start of field work. For RI activities it is not required to complete the R7 QAPP Addendum Form, but the site-specific QAPP shall be reviewed and approved by the Regional Quality Assurance Manager prior to the start of field work. The specific data to be assessed and obtained in additional to the potential sources contamination during the SA, ISA, RSE and RI activities are summarized in Table 2.

TABLE 2 Specific Data		
Sample Summary Location	Matrix	Analysis
Residential yards, school yards, parks, daycare centers	Soil	arsenic, barium, cadmium, lead
Stream beds, creeks, ponds, rivers, lagoons, drainage pathways	Soil/Sediment	lead (total)
Borrow sources, rock quarries	Soil/rock	arsenic, barium, cadmium, lead (total) and TCLP-arsenic, barium, cadmium and lead
Municipal Wells	Water	arsenic, barium, cadmium, lead (total and dissolved)
Private Wells	Water	arsenic, barium, cadmium, lead (total and dissolved)
Surface Water	Water	arsenic, barium, cadmium, lead (total)
Interior of private residences (if conditions warrant)	Dust/Wipes	lead (total)
Areas impacted by disturbed contaminated soils, downwind of the site (if conditions warrant)	Air	lead (total)
QC Samples		
Field duplicates	Soil	arsenic, barium, cadmium, lead (total)
Field blanks	Water	arsenic, barium, cadmium, lead (total)
Field duplicates (municipal and private wells)	Water	arsenic, barium, cadmium, lead (lead (total and dissolved)

2.5 Quality Objectives and Criteria for Measurement Data

This section describes quality specifications at two levels: (1) at the level of the decision or study question, and (2) at the level of the measurements used to support the decision or study questions. EPA has developed the Data Quality Objectives (DQO) Process as the Agency's recommended planning process when environmental data are used to select between two alternatives or derive an estimate of contamination. EPA's DQO process is a systematic planning tool designed to ensure that the type, quantity, and quality of measurement data collected are the most appropriate for supporting decisions that will be based on that data. The DQO process will be used, either formally or informally, for all data collection activities conducted under the EPA Environmental Services contracts to provide the most cost-effective use of program resources. This section describes how the contractor will apply EPA's DQO process to determine the type of data required and presents specific QA objectives for measurement data.

2.5.1 Data Quality Objectives Process

The DQO Process is used to develop performance and acceptance criteria (or data quality objectives) that clarify study objective, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. The EPA document, Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4 (EPA, 2006a), provides a standard working tool for project managers and planners to develop DQO for determining the type, quantity, and quality of data needed to reach defensible decisions or make credible estimates. It replaces EPA's August 2000 document, Guidance for the Data Quality Objectives Process (EPA QA/G-4), that considered decision-making only.

The EPA document, Systematic Planning: A Case Study for Hazardous Waste Investigations EPA QA/CS-1 (EPA, 2006b) shows the use of the DQO Process in the form of a case study. For projects that require data collection, the contractor will follow EPA's DQO process as described in the above guidance documents.

The EPA document, Superfund Lead-Contaminated Residential Sites Handbook, OSWER 9285.7-50 (EPA, 2003), was developed by the EPA to promote a nationally consistent decision-making process for assessing and managing risks associated with lead-contaminated residential sites across the country.

The EPA document, Guidance Manual for the IEUBK Model for Lead in Children, OSWER 9285.7-15-1 (EPA, 1994b) has been developed to assist the user in providing appropriate input to the Integrated Exposure Uptake Biokinetic IEUBK Model for Lead. The IEUBK Model is designed to model exposure form lead in air, water, soil, dust, diet, and paint and other sources with pharmacokinetic modeling to predict blood lead levels in children 6 months to 7 years.

The DQO Process is used to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study. The DQO Process consists of seven iterative steps that are documented in Figure 1. While the interaction of these steps is portrayed in Figure 1 in a sequential fashion, the iterative nature of the DQO Process allows one or more of these steps to be revisited as more information on the problem is obtained.

Each step of the DQO Process defines criteria that will be used to establish the final data collection design. The first five steps are primarily focused on identifying qualitative criteria, such as:

- the nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated;
- the decisions or estimates that need to be made and the order of priority for resolving them;
- the type of data needed; and
- an analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings.

The sixth step establishes acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data. These criteria are known as performance or acceptance criteria, or DQOs. For decision problems, the DQOs are typically expressed as tolerable limits on the probability or chance (risk) of the collected data leading you to making an erroneous decision. For estimation problems, the DQOs are typically expressed in terms of acceptable uncertainty (e.g., width of an uncertainty band or interval) associated with a point estimate at a desired level of statistical confidence.

In the seventh step of the DQO Process, a data collection design is developed that will generate data meeting the quantitative and qualitative criteria specified at the end of Step 6. A data collection design specifies the type, number, location, and physical quantity of samples and data, as well as the QA and QC activities that will ensure that sampling design and measurement errors are managed sufficiently to meet the performance or acceptance criteria specified in the DQOs. The outputs of the DQO Process are used to develop a QA Project Plan and for performing Data Quality Assessment.

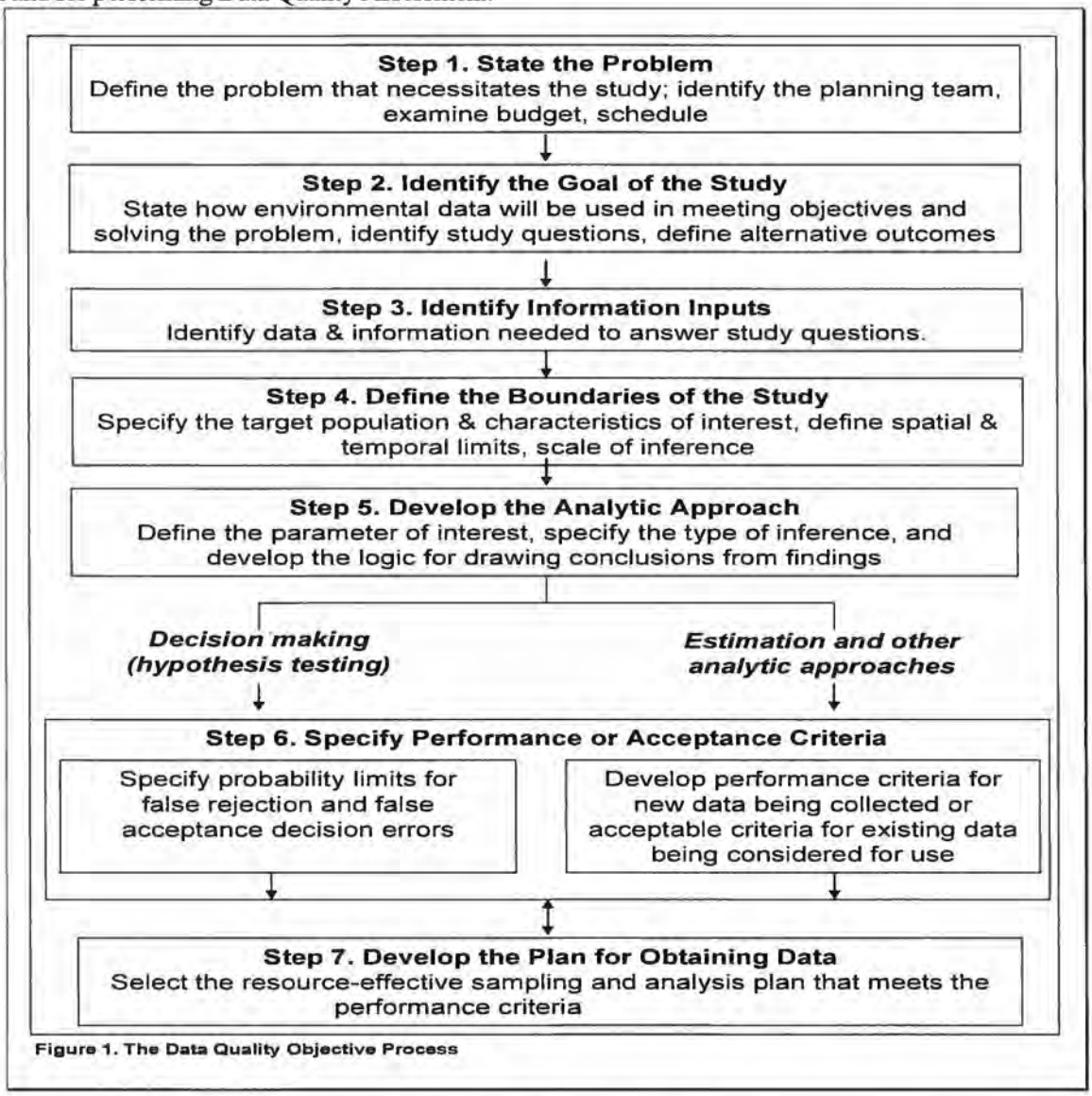

Figure 1. The Data Quality Objective Process

All seven steps of the DQO process may not be applicable to all environmental data collection activities. Examples include activities where specific decisions cannot be identified or studies that are exploratory in nature. In these situations, the contractor will use the steps of the DQO process that are applicable to help plan the data collection effort.

The DQO process is not complete without a final evaluation, after sample collection and analysis has been completed, of whether DQOs were met. This evaluation, called data quality assessment (DQA), is described in Section 5.3 of this Generic QAPP.

2.5.2 Data Quality Objectives and Criteria for Measurement Data

The **Pre-Remedial, Removal and Remedial Programs** each have their unique process and ultimate goals in addressing the threat to human health and the environment. The **Pre-Remedial Program** process is to conduct an initial investigation to determine if threats to the public health and environment actually or potentially exist. During the Pre-Remedial process the human health and ecological threats are identified and a numerical score is obtained to determine the potential for placing the site on the National Priorities List. The **Removal Program** process is to conduct investigations to determine if a removal action (i.e., time-critical or non-time critical) are warranted at a site being investigated. These removal actions can occur during the Pre-Remedial or Remedial phase of the Superfund Process. The **Remedial Program** process is to conduct investigations (i.e., Remedial Investigations) for gathering data for the Baseline Risk Assessment for human health and the ecology, and to determine the extent of contamination. The ultimate success of an environmental data collection effort at Superfund mining, milling and smelter sites contaminated with lead (includes: arsenic, barium, and cadmium) depends on the quality of the data collected and used to make decisions.

2.5.2.1 Pre-Remedial Program

The Pre-Remedial Program process is to conduct an initial investigation to determine if threats to the public health and environment actually or potentially exist. During the Pre-Remedial process the human health and ecological threats are identified and a numerical score is obtained to determine the potential for placing the site on the National Priorities List.

The sampling activities that are emphasized in the Pre-Remedial Program are the soil, waste, surface water, sediment, groundwater, and private and public wells.

2.5.2.1.1 Measurement Objectives for the Pre-Remedial Program

A general description of and rationale for sampling design and field procedures for Pre-Remedial Program Process is provided below:

Soil Sampling: The purpose of soil sampling is to determine if the soils pose a threat to human health and the environment due to the presence of metals and other contaminants. The primary objectives of soil sampling is to determine if threats to the public health and environment actually or potentially exist from tailings or other waste sources in soils down gradient or downwind from known waste sources and in residential yards (including rights-of way, alleyways, unpaved roads, street easements, and drainage ways) and to provide data to use in developing Hazard Ranking Packages.

Soil samples will be collected near waste areas and in floodplains where stream flows may have deposited tailings, chat, or other waste materials during flood events which over topped the immediate channel banks. Soil samples will also be collected from residential yards, public areas, alleys, street easements, road rights-of-way and drainage ways and surrounding areas. Samples will be discrete samples of surface soils taken at 0 to 1 inches. This depth is necessary to evaluate both the surface horizons for human health and ecological receptors.

The Superfund Lead-Contaminated Residential Sites Handbook, (EPA, 2003) should be consulted for further information on sampling design.

Waste sampling: Various types of waste materials are related to former mining and mineral processing activities. Waste sampling should target areas of known waste material and identified areas. The purpose of sampling these wastes is to determine if threats to the public health and environment actually or potentially

exist. In general, tailings and chat areas should be sampled at 0-4 foot, 4-8 foot and continue at 4-foot intervals to depth using Direct Push Technology (DPT). Composite sampling using shovels should be used at any identified waste rock dumps.

***Surface water quality sampling of creeks, rivers and ponds*:** The purpose of surface water quality sampling is to determine if contaminants, primarily total and dissolved metals, in the suspended water column provide a threat to human health and the environment. The primary objectives of water quality sampling are to determine if threats to the public health and environment actually or potentially exist.

***Sediment sampling of streams, rivers and ponds*:** The purpose of sediment sampling is to determine if threats to the public health and environment actually or potentially exist from the various sediments and potential metal flocculants in stream, river, and pond substrates.

Fine sediment fractions are more easily transported and often contain metal complexes and flocculants that are more bioavailable to receptors than coarse fractions. The larger size fractions of many area wastes, particularly chat, are not transported as easily as fine fractions and are not as available to be ingested or adsorbed by humans or aquatic organisms. All sediment samples will be collected and screened to separate the sample into two size fractions for chemical and risk analyses. Samples should be sieved using a Number 35 sieve to separate sediment into size fractions greater than, and less than 0.5 millimeters (mm). This size (0.5 mm) will separate samples into fractions greater than coarse sands and less than medium to fine sands. Evaluating data from both of these size fractions will allow several inferences to be made regarding the nature and extent and transport of waste materials and the risk associated with the different size materials.

***Groundwater sampling*:** The purpose of sampling groundwater is to determine if threats to the public health and environment actually or potentially exist. The primary objectives of sampling groundwater from (other than drinking water wells) are to: (1) determine the water quality and potential exposure levels to human health in areas where residential drinking water wells could be affected by mining activities; and (2) determine groundwater quality in areas associated with mining operations and mining wastes. These objectives will be met by measuring the groundwater potentiometric surface and evaluating observed gradients.

***Residential drinking water well sampling*:** The purpose of sampling potable water from residential drinking water wells is to determine if threats to the public health and environment actually or potentially exist. The primary objectives of sampling potable water from residential drinking water wells is to: (1) determine the water quality and potential exposure levels to human health in residential drinking water wells affected by mining activities; and (2) determine groundwater quality associated with mining operations and mining wastes.

The collection of drinking water samples will follow SOP 4230.1A,"Drinking Water Sample Collection". In addition, two unfiltered drinking water samples will be collected. One sample will be from the well head and the other sample will be taken at the tap or the faucet.

2.5.2.2 Removal Program

The Removal Program process is to conduct investigations to determine if a removal action (i.e., emergency, time-critical or non-time critical) are warranted at a site being investigated. These investigations are called removal site evaluation and are based on whether site conditions meet National Contingency Plan (NCP) criteria for a removal action.

The sampling activities that are emphasized in the Removal Program are the soil, waste, sediment/surface water, interior dust, interior/exterior lead-based paint, outdoor air monitoring and private wells.

2.5.2.2.1 Measurement Objectives for the Removal Program

A general description of and rationale for sampling design and field procedures for Removal Program Process is provided below:

Soil Sampling: The purpose of soil sampling is to determine if the soils provide a threat to human health and the environment due to the presence of metals and other contaminants, and identify the extent that this contamination may impact removal decision-making. The primary objectives of soil sampling are to: (1) characterize the nature and extent of contamination by tailings or other waste sources in soils downgradient or down-wind from known waste sources and in residential yards (including rights-of way, alleyways, unpaved roads, street easements, and drainage ways); (2) provide information to allow the risks to human health from exposure to contamination in these areas to be evaluated; (3) determine the chemical stressors that may affect vegetation establishment and/or risk to other ecological receptors; (4) determine whether the level of soil contamination qualifies for removal action; and (5) determine the soil lead levels at the base of the excavation after soil removal.

Soil samples will be collected near waste areas and in floodplains where stream flows may have deposited tailings, chat, or other waste materials during flood events which over topped the immediate channel banks. Soil samples will also be collected from residential yards, public areas, alleys, street easements, road rights-of-way and drainage ways and surrounding areas. Characterization samples will be a combination of discrete and composite samples of surface soils taken from the upper portion of the 0 to 1 inches depth. This depth is necessary to evaluate both the surface horizons for human health and ecological receptors, and the subsurface root-zone to determine the limitations and potential toxicity to plants and soil organisms. The samples should also be properly sieved to determine the metals concentration in the fine fraction of the surface soils Composites should consist of aliquots collected from the same depth. More details on yard soil sampling design can be found in the Superfund Lead-Contaminated Residential Sites Handbook, (EPA, 2003).

Waste sampling: Various types of waste materials are related to former mining and mineral processing activities. Waste sampling should target areas of known waste material and identified areas. The primary objectives of sampling these wastes is to: (1) determine and characterize their bulk geochemistry; (2) characterize the extent of the waste areas; (3) measure the potential for acid generation within the waste rock dumps at the mine area and within the tailing piles; (4) delineate the fate and transport of wastes from wind and water erosion from the main source; and (5) characterize potential exposure concentrations to human and ecological receptors. In general, tailings and chat areas should be sampled at 0-4 foot, 4-8 foot and continue at 4-foot intervals to depth using DPT. Composite sampling using shovels should be used at any identified waste rock dumps.

Surface water quality sampling of creeks, rivers and ponds: The purpose of surface water quality sampling is to determine if contaminants, primarily total and dissolved metals, in the suspended water column provide a threat to human health and the environment. The primary objectives of water quality sampling are to: (1) characterize the water quality and potential exposure potential to human and ecological receptors due to contact with or consumption of that water; (2) evaluate the geochemistry of the water to determine potential relationships between dissolved and total metal species, as well as determine any significant metal sorption and desorption relationships that could exist between channel substrate sediments and the water column; and (3) determine the extent and degree of transport of contaminants downstream and exposure effects to human health and ecological receptors associated with that transport.

Sediment sampling of streams, rivers and ponds: The primary objectives of sediment sampling are to: (1) define the quality of various sediments and potential metal flocculants in stream, river, and pond

substrates; (2) determine potential interactions between substrate sediments and surface water quality near the water-sediment interface and the overall water column; and (3) determine potential exposure concentrations to human health and ecological receptors to coarse and fine sediment fractions.

Fine sediment fractions are more easily transported and often contain metal complexes and flocculants that are more bioavailable to receptors than coarse fractions. The larger size fractions of many area wastes, particularly chat, are not transported as easily as fine fractions and are not as available to be ingested or adsorbed by humans or aquatic organisms. All sediment samples will be collected and screened to separate the sample into two size fractions for chemical and risk analyses. Samples should be sieved using a Number 35 sieve to separate sediment into size fractions greater than, and less than 0.5 millimeters (mm). This size (0.5 mm) will separate samples into fractions greater than coarse sands and less than medium to fine sands. Evaluating data from both of these size fractions will allow several inferences to be made regarding the nature and extent and transport of waste materials and the risk associated with the different size materials.

***Indoor dust and interior/exterior lead-based paint sampling*:** The primary objectives for the collection and analysis of dust samples and analysis of the interior/exterior paint in residential homes are to: (1) determine the extent of lead contamination in dust from residential homes; (2) determine whether the homes that are sampled for dust also contain lead-based paint; and (3) to collect data that can be included in the IEUBK model (EPA, 1994b and EPA, 2002c) that will be used to prepare the human health risk assessment.

Outdoor air monitoring: The purpose of air monitoring is to determine if: (1) contaminants have become airborne; (2) the presence of a continuing release of hazardous constituents to the environment; and (3) evaluate any changes in field activities that can reduce the concentration of airborne contaminants.

***Residential drinking water well sampling*:** The primary objectives of sampling potable water from residential drinking water wells is to determine the water quality exposure levels to humans so that potential health risks posed by potable water in residential drinking water wells can be evaluated.

The collection of drinking water samples will follow SOP 4230.1A,"Drinking Water Sample Collection". In addition, two unfiltered drinking water samples will be collected. One sample will be from the well head and the other sample will be taken at the tap or the faucet.

2.5.2.3 Remedial Program

The Remedial Program process is to conduct investigations (i.e., Remedial Investigations) for gathering data for the Baseline Risk Assessment for human health and the ecology, and to determine the extent of contamination.

The sampling activities that are emphasized in the Remedial Program are the soil, sediment, surface water, mine wastes, groundwater, interior lead-based paint/interior dust, exterior lead-based paint, air monitoring and private wells.
The sampling activities that are emphasized in the Removal Program are the soil, waste, surface water, sediment, interior dust, interior/exterior lead-based paint, outdoor air monitoring and private wells, bioaccessability/bioavailability and speciation/apportionment.

The overall quality assurance objective for the remedial investigations for most sites is to develop and implement procedures for field sampling, chain-of-custody (COC), laboratory analysis, and reporting that provide technically and legally defensible results to be used to delineate the nature and extent of contamination, evaluate contaminant migration, assess ecological and human health risk, and support the remedial decision-making process.

2.5.2.3.1 Measurement Objectives for the Remedial Program

A general description of and rationale for sampling design and field procedures for Remedial Program Process is provided below:

***Soil Sampling*:** The purpose of soil sampling is to determine if the soils present a threat to human health and the environment due to the presence of metals and other contaminants, and identify the extent that this contamination may impact remedial decision-making. The primary objectives of soil sampling are to: (1) characterize the nature and extent of contamination by tailings or other waste sources in soils downgradient or down-wind from known waste sources and in residential yards (including rights-of way, alleyways, unpaved roads, street easements, and drainage ways); (2) provide information to allow the risks to human health from exposure to contamination in these areas to be evaluated; (3) determine the chemical stressors that may affect vegetation establishment and/or risk to other ecological receptors; (4) determine whether the level of soil contamination qualifies for removal action; (5) determine the soil lead levels at the base of the excavation after soil removal; and (6) data to support the IEUBK Model (EPA, 1994b and EPA, 2002c).

Soil samples will be collected near waste areas and in floodplains where stream flows may have deposited tailings, chat, or other waste materials during flood events which over topped the immediate channel banks. Soil samples will also be collected from residential yards, public areas, alleys, street easements, road rights-of-way and drainage ways and surrounding areas. Characterization samples will be a combination of discrete and composite samples of surface soils taken from the upper portion of the 0 to 1 inches depth. This depth is necessary to evaluate both the surface horizons for human health and ecological receptors, and the subsurface root-zone to determine the limitations and potential toxicity to plants and soil organisms. The samples should also be properly sieved to determine the metals concentration in the fine fraction of the surface soils Composites should consist of aliquots collected from the same depth. More details on yard soil sampling design can be found in the Superfund Lead-Contaminated Residential Sites Handbook, (EPA, 2003).

***Waste sampling*:** Various types of waste materials are related to former mining and mineral processing activities. Waste sampling should target areas of known waste material and identified areas. The primary objectives of sampling these wastes is to: (1) determine and characterize their bulk geochemistry; (2) characterize the extent of the waste areas; (3) measure the potential for acid generation within the waste rock dumps at the mine area and within the tailing piles; (4) delineate the fate and transport of wastes from wind and water erosion from the main source; and (5) characterize potential exposure concentrations to human and ecological receptors. In general, tailings and chat areas should be sampled at 0-4 foot, 4-8 foot and continue at 4-foot intervals to depth using DPT. Composite sampling using shovels should be used at any identified waste rock dumps.

***Surface water quality sampling of creeks, rivers and ponds*:** The purpose of surface water quality sampling is to determine if contaminants, primarily total and dissolved metals, in the suspended water column provide a threat to human health and the environment. The primary objectives of water quality sampling are to: (1) characterize the water quality and potential exposure potential to human and ecological receptors due to contact with or consumption of that water; (2) evaluate the geochemistry of the water to determine potential relationships between dissolved and total metal species, as well as determine any significant metal sorption and desorption relationships that could exist between channel substrate sediments and the water column; and (3) determine the extent and degree of transport of contaminants downstream and exposure effects to human health and ecological receptors associated with that transport.

***Sediment sampling of streams, rivers and ponds*:** The primary objectives of sediment sampling are to: (1) define the quality of various sediments and potential metal flocculants in stream, river, and pond

substrates; (2) determine potential interactions between substrate sediments and surface water quality near the water-sediment interface and the overall water column; and (3) determine potential exposure concentrations to human health and ecological receptors to coarse and fine sediment fractions. Fine sediment fractions are more easily transported and often contain metal complexes and flocculants that are more bioavailable to receptors than coarse fractions. The larger size fractions of many area wastes, particularly chat, are not transported as easily as fine fractions and are not as available to be ingested or adsorbed by humans or aquatic organisms. All sediment samples will be collected and screened to separate the sample into two size fractions for chemical and risk analyses. Samples should be sieved using a Number 35 sieve to separate sediment into size fractions greater than, and less than 0.5 millimeters (mm). This size (0.5 mm) will separate samples into fractions greater than coarse sands and less than medium to fine sands. Evaluating data from both of these size fractions will allow several inferences to be made regarding the nature and extent and transport of waste materials and the risk associated with the different size materials.

***Groundwater sampling*:** The primary objectives of sampling groundwater (other than drinking water wells are to: (1) determine the water quality and potential exposure levels to human health in areas where residential drinking water wells could be affected by mining activities; (2) determine groundwater quality in areas associated with mining operations and mining wastes; (3) determine the nature and extent of contamination in groundwater from mining activities and wastes; and (4) evaluate potential impacts from the transport of contaminated groundwater to surface water sources or other area potable wells. These objectives will be met by measuring the groundwater potentiometric surface and evaluating observed gradients.

***Indoor dust and interior/exterior lead-based paint sampling*:** The primary objectives for the collection and analysis of dust samples and analysis of the interior/exterior paint in residential homes are to: (1) determine the extent of lead contamination in dust from residential homes; (2) determine whether the homes that are sampled for dust also contain lead-based paint; and (3) to collect data that can be included in the IEUBK model (EPA, 1994b and EPA, 2002c) that will be used to prepare the human health risk assessment.

Outdoor air monitoring: The purpose of air monitoring is to determine if: (1) contaminants have become airborne; (2) the presence of a continuing release of hazardous constituents to the environment; and (3) evaluate any changes in field activities that can reduce the concentration of airborne contaminants.

***Residential drinking water well sampling*:** The primary objectives of sampling potable water from residential drinking water wells are to: (1) determine the water quality and potential exposure levels to humans so that potential health risks posed by potable water in residential drinking water wells can be evaluated; and (2) further determine the nature and extent of contamination in groundwater in areas associated with mining operations and mine wastes.

The collection of drinking water samples will follow SOP 4230.1A,"Drinking Water Sample Collection". In addition, two unfiltered drinking water samples will be collected. One sample will be from the well head and the other sample will be taken at the tap or the faucet.

Bioaccessability/bioavailability sampling: The primary objective for collection and analysis of soil and dust samples to measure bioaccessability/bioavailability is to provide site specific input parameters to the IEUBK model (EPA, 1994b and EPA, 2002c) in determining site risk and PRGs. Samples for these analyses should be collected in the same manner as the soil and dust samples above.

Speciation/Apportionment sampling: The primary objective of this sampling and analysis of soil, dust, paint, and other sources of metals contamination is to determine the primary sources of the metals

contamination in the soil and dust at residential properties. This analysis is also useful in developing the soil to dust ratio for input to the IEUBK model (EPA, 1994b and EPA, 2002c).

2.5.3 Quality Assurance Objectives for Measurement Data

The project data quality objective is to provide valid data of known and documented quality to determine the levels of lead contamination for comparison to benchmarks. Quality assurance (QA) objectives are usually discussed in terms of accuracy, precision, sensitivity, completeness, representativeness and comparability. Sample collection and field measurement activities will be performed based on SOPs discussed throughout Section 3.0. Analytical results for laboratory blanks, duplicates and QC samples, as well as field blanks and field duplicates will be evaluated to determine bias and representativeness.

The overall QA objective for the EPA contract is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and data reporting that will provide results that will facilitate sound decision-making to protect human health and the environment, support regulatory findings, and that are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this Generic QAPP. The purpose of this section is to address the level of QC effort and the specific QA objectives for sensitivity, accuracy, precision, representativeness, completeness, and comparability of data.

Because of the general nature of this Generic QAPP, it is not possible to provide specific quantitative QA objectives for each environmental measurement and each type of sample matrix. In addition, these QA objectives will depend on the results of the DQO process. However, each project-specific QAPP or work plan with site-specific QAPP Addendum will identify the matrices to be sampled, the numbers of samples that will be collected, and the types of field and laboratory measurements that will be applied to the samples. For each sample matrix and environmental measurement type, the project QA/QC document will specify QA objectives in terms of the following information: types of QC samples and measurements involved, frequency of collection and analysis of QC samples and measurements, how the QA objective is measured, the acceptance criteria or QC limits for that measurement, and corrective action to be taken when a QC limit is not met.

All analytical data will be evaluated for compliance with QC limits. Typically, when analytical data do not meet the QC limits, corrective action might be initiated and the data might be qualified or rejected. Corrective action may include stopping the analysis; examining instrument performance, sample preparation, and analysis information; recalibrating instruments; re-preparing and reanalyzing samples; and informing the contractor's Contract Administrator, contractor's Quality Assurance Manager, and the contractor's Project Manager of the problem.

The following subsections address the level of QC effort and general objectives for sensitivity; accuracy and precision; and representativeness, completeness, and comparability of data.

2.5.3.1 Sensitivity

Sensitivity is based on the minimum concentration that a substance can be measured and reported with 99% confidence that the concentration is greater than zero. This is generally expressed in the form of the method detection limit (MDL) or quantitation limit for the analytical method selected. The equation used to calculate MDL is presented in Section 3.5.

The lowest concentration that can be reliably achieved within the specified limits of precision and accuracy during routine laboratory operating conditions is termed estimated quantitation limit (EQL). The EQL is generally 3 to 5 times greater than the MDL. The sample quantitation limit (SQL) is the quantity based on sample dilution where the EQL is multiplied by a dilution factor. If the SQL is higher than the EQL for any analysis resulting from causes other than high analyte concentrations, the project manager will discuss corrective actions with the laboratory manager and quality control officer.

Each project-specific QAPP or work plan/SAP with a site-specific QAPP Addendum will provide the concentrations of concern for contaminants known or suspected to be present at the sampling location. This information should be provided in Section 2.3 - Problem Definition and Background. The concentrations of concern will be based on risk-based criteria, regulatory limits, and other similar guidelines. The project-specific QAPP or the work plan/SAP document with site-specific QAPP Addendum will also provide the required detection limits and quantitation limits for these analytes in various matrices based upon their concentrations of concern. Quantitation limits reflect the influences of the sample matrix on method sensitivity and are typically higher than detection limits. Quantitation limits provide a more reliable indication of the amount of material needed to produce an instrument response that can be routinely identified and reliably quantified when applying a particular analytical method to real environmental samples.

For all work conducted under the EPA contracts, the contractor will select analytical methods with sensitivities appropriate to the intended data use. Whenever possible, analytical methods will be specified such that matrix-specific reporting limits are lower than any contaminant concentrations of concern.

2.5.3.2 Precision

Precision is a measure of the variability of a measurement system. Precision is typically estimated by means of duplicate and replicate measurements and is expressed in terms of relative percent difference (RPD). Equations for calculating RPD are presented in Section 3.5 of this Generic QAPP. For field sampling, precision is increased by following SOPs and by collecting all samples using the same sampling procedures. Field QC samples that are collected to measure precision include field duplicate samples (i.e., transport and field handling bias) and include collocated samples (i.e., sampling and measurement precision). Field measurement precision is monitored by taking replicate measurements. Field measurement precision is increased through proper operation and maintenance of field equipment.

The specific QA objectives for precision should be provided in the site-specific QAPP Addendum or Field Sampling Plan for the use of XRF equipment in analyzing soil samples.

Precision for laboratory analyses will be measured by collecting and analyzing the following types of samples: field split samples, MS/MSD samples for organic and inorganic analyses, matrix duplicate samples for inorganic analyses, and laboratory control samples (LCS) and LCS duplicate samples.

Because field and laboratory measurements and sample matrices will vary with each investigation, the specific QA objectives for precision and accuracy will be provided in the project-specific QAPP or site-specific work plan containing SAP-level QA/QC information and a completed R7 QAPP Addendum Form for SA, ISA and RSE activities. This information is presented most clearly in a table or a series of tables.

Precision is evaluated using the RPD between the results of the MS and the MSD samples. This precision evaluation can also be performed using the RPD between a blank spike (BS) and blank spikes duplicate (BSD). The spiked samples are laboratory samples that have been fortified. Precision for the fieldwork is evaluated by using the RPD between the results for the field duplicate samples. A RPD goal of +/-25%

(i.e. 75% to 125%) will be used for both field and lab analyses and will be included in the task assignment. Precision determined using RPD would be calculated as follows:

$$RPD = \left[\frac{2x(X_1 - X_2)}{(X_1 + X_2)} \right] \times 100$$

where: X_1 = analyze concentration in the sample

X_2 = analyze concentration in the duplicate

2.5.3.3 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy is typically expressed as percent recovery (%R) from spiked samples or bias with respect to a reference standard. The use of spiked samples permits a constant check on method accuracy and provides an indication of the degree of matrix effect. Equations to calculate accuracy in terms of %R are presented in Section 3.5 of this Generic QAPP.

The specific QA objectives for accuracy should be provided in the site-specific QAPP Addendum or Field Sampling Plan for the use of XRF equipment in analyzing soil samples.

Accuracy for field sampling will be increased by establishing a sound sampling strategy and following appropriate SOPs. The field QC samples are collected to measure accuracy include trip blanks, field blanks, and equipment rinsate blanks. In general, the accuracy of field measurements will be increased by following appropriate SOPs and through proper calibration and maintenance of equipment. QC measures used to monitor the accuracy of field measurements include checking instrument responses against calibration standards.

Accuracy for laboratory analyses will be assessed by collecting and analyzing the following types of QC samples: MS/MSD samples for organic analyses, MS/MSD and matrix duplicate samples for inorganic analyses, and laboratory QC check samples. Additional volumes for MS/MSD samples and matrix duplicate samples are collected in the field. Other QC check samples used to assess accuracy are prepared in the laboratory. These laboratory check samples may include blank spikes, surrogate spikes, method blanks, reagent blanks, instrument blanks, calibration blanks, laboratory control samples, standard reference materials, and independent check standards.

Accuracy is evaluated by using the %R of the MS/MSDs and laboratory blank spike samples (BS/BSDs). An accuracy goal of +/- 20% of recovery (i.e. 80% to 120%) will be used. Accuracy as determined by the %R would be calculated as follows:

$$\%R = \left[\frac{X_4 - X_u}{K} \right] \times 100$$

where: X_4 = measured value of spiked sample or blank

X_u = measured value of unspoiled sample or blank

K = known amount of the spike in the sample or blank

2.5.3.4 Representativeness

Representativeness refers to the extent that the sample data precisely and accurately represent the characteristics of a group of samples, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that depends on the proper design of the sampling program and proper laboratory protocol. The sampling network for each investigation will be designed to provide data representative of environmental conditions. During development of the sampling network, consideration will be given to past waste disposal practices, existing analytical data, current and former on-site physical setting and processes, and other relevant information. This QA parameter is a measure of the design of the sampling program and use of appropriate sampling techniques, and is evaluated using the field duplicates, trip blanks, method blanks and laboratory confirmation results.

Field duplicates provide a measure of assurance that the samples are representative of the sampling point. The effects of shipping and transporting the VOC samples are assessed with trip and field blanks. Method blanks are used to determine if cross contamination has taken place in the laboratory.

Representativeness can also be affected by the time, place, and manner by which the samples are collected. In many cases, project planners account for the difficulty in knowing when, where, and how to collect representative samples by developing statistical or random sampling networks; collecting more samples than would otherwise be needed; collecting samples at several different phases of natural or anthropogenic cycles; sampling at different locations within the project area; collecting composite samples as opposed to grab samples; and verifying and validating the sampling techniques in separate studies. The site-specific study will identify specific methods for achieving and demonstrating the representativeness of the samples to be collected.

Representativeness will also be satisfied by ensuring that this Generic QAPP with appropriate site-specific QAPP Addendum is followed, samples are collected in accordance with appropriate SOPs or by proper sampling techniques when SOPs are not available, proper analytical procedures are followed, and holding times of the samples are not exceeded in the laboratory.

2.5.3.5 Comparability

This QA parameter is qualitative in signifying the confidence with which one data set can be compared with another. The sample data should be comparable to other measurement data for similar samples and sampling conditions. This parameter is achieved through standard sample collection techniques, analyses, and reporting the analytical results in appropriate units.

Generally, comparability will be attained by achieving the QA objectives for sensitivity, accuracy, precision, completeness, and representativeness given in this Generic QAPP or in the site-specific QAPP Addendum or project-specific QAPP. Following field and laboratory procedures consistently for individual investigations and for this contract will also achieve comparability of data. EPA-approved standard field procedures such as those discussed in Section 3.2 of this Generic QAPP will be used to the extent possible. EPA-approved laboratory methods such as those listed in the Contract Laboratory Program Statements of Work and in SW-846 will be used to increase the comparability of laboratory analytical data generated under this contract.

2.5.3.6 Completeness

Completeness is a measure of sample collection usability and whether the data quality has been met. Completeness is a measure of the amount of valid data obtained from a measurement system compared to the total number of measurements necessary to achieve a specified level of confidence in decision-making. Completeness of sample collection is the ratio of the samples actually collected to the number of samples planned to be collected. The typical goal for most sample collection events is 95%. The completeness of usable data is the ratio of data that is not rejected to the total number of data points. The completeness of quality data is the ratio of data that is qualified to the total number of data points. The goals for these components are 95% and 80%, respectively. The EPA Project Manager will determine if the completeness goals have been met for the field and lab data. If changes to the site-specific QAPP Addendum or project-specific QAPP are necessary based on site-specific conditions, these will be documented in a QAPP revision for review and approval.

Following completion of analytical testing, the percent completeness will be calculated according to the equation presented in Section 3.5 of this Generic QAPP. In a site-specific QAPP Addendum or project-specific QAPP (where necessary) the QA objectives for completeness will be documented and explained in the site-specific QAPP Addendum or project-specific QAPP. For those sites that will include parameters other those specific to this Generic QAPP, the companion Generic QAPP (i.e., Generic Quality Assurance Project Plan for the Superfund Integrated Site Assessment and Targeted Brownfield's Assessment Programs, dated July 2007) shall be used to complete the site-specific QAPP Addendum or project-specific QAPP.

2.6 Site Assessment, Integrated Site Assessment, Removal Site Evaluation and Remedial Investigations Data Categories

The data quality objectives (DQOs) for the activities performed under the SA, ISA, RSE, and RI activities should ensure that environmental data obtained meet the needs of the study and can be used with confidence to support specific decisions (both administrative and regulatory) pertaining to the site. DQOs specify the quality of data required from a particular activity to support specific decisions. Specific DQOs from the list of those outlined under this Generic QAPP will be identified and documented in the R7 QAPP Addendum Form for SA, ISA, and RSE activities, in accordance with Guidance on Systematic Planning using the Data Quality Objectives Process EPA QA/G-4 (EPA, 2006a).

There are eight removal factors listed in the NCP [NCP §300.415(b)(2)] evaluated to define the problem and therefore determine the action to be taken:

- Actual or potential exposure of nearby human populations, animals, or the food chain;
- Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- Existence of hazardous substances in containers that pose a threat of release;
- Existence of highly contaminated surface soils that could migrate;
- Weather conditions that could cause hazardous substances to be released or migrate;
- Threat of fire or explosion;
- Availability of other response or enforcement mechanisms; or
- Other situations or factors that may pose a threat.

For ISA, different types (and typically greater quantities) of data are necessary than are required for a removal site evaluation alone. For example, in a site inspection and removal site evaluation, a background sample must be taken for each matrix to be analyzed, a trip blank should be used, and composite sampling gives more information economically. Additional attention is paid to pathways and

possible receptors, since scoring for a site is accomplished with this data. A concerted effort is made to connect the contamination with the site sources.

2.6.1 Superfund Data Categories

Two Superfund data categories have been established, which are referred to as: 1) Screening data with or without definitive confirmation results; and 2) Definitive data. These categories segregate environmentally related measurement data into two groups, which are based primarily on increasing levels of confidence in the precision and accuracy of the analytical results. Screening data without definitive confirmation results are considered to be data of unknown quality and are preliminary in nature. Screening data with definitive confirmation results comprise data of known quality that are quantitatively "verified" and for which the analyte identification is "definitively" confirmed. Definitive data include all measurements that are performed through analyte-specific EPA-approved methodologies that definitively identify and quantify the analyte of interest. The data categories are described in more detail in Sections 3.1 and 3.2. Screening results will be used to select the type and location of analytical samples, including those that would be used for definitive confirmation. The data quality available from current field screening technologies is acceptable for this purpose.

For SA, ISA, RSE, and RI activities, either of the data categories may be used to determine the necessity for further action at the site. The appropriate category that will be used will be determined by the EPA Project Manager and will be dependent on the specific activity and required data use.

2.6.2 Screening Data With/Without Definitive Confirmation Results

The screening category is a broad classification that includes measurements that can be non-quantitative to semi-quantitative, or involve only probable identification of a compound class. This category will be appropriate for data collection activities that involve rapid, non-rigorous measurement or analytical procedures and limited quality assurance/quality control (QA/QC) requirements. The screening methods will be used to make quick assessments of the types and levels of pollutants. Screening will often be employed during SA, ISA and RSE activities and may be performed during preliminary site characterization and/or delineation of the extent of contamination across the site. The use of screening techniques will generally be confined to sites where the types of contamination are either known or suspected and/or where additional data are needed to expand on existing information.

Definitive confirmation refers to the analysis of samples by a technique that can unequivocally detect the specific analyte in question and that can produce verifiable documentation that the analyte identification is correct. A parameter of interest is considered to be valid if the precision and accuracy of the data have been determined to be within EPA-established control limits. For ISA and RSE activities, the screening data with definitive confirmation category will be applied to assessment and characterization activities where a higher level of confidence is required for the data. A minimum of 10% of the screening measurements performed under this category will be confirmed with data that meet definitive requirements. Consequently, if the results of the confirmation analyses substantiate those screening data, a higher level of confidence may be given to the remaining 90% of the screening data.

2.6.3 Definitive Data

The most exhaustive category is definitive data, which is appropriate when rigorous, EPA-approved methods of analysis and comprehensive QA/QC procedures are necessary. For ISA, RSE, and RI activities, this category will be applied when a highly significant cost or risk is associated with an incorrect decision. Definitive data are analyte-specific, with confirmation of analyte identities and concentrations. Data may be generated at the site or at an off-site location, as long as the QA/QC

requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined. See Section 2.5 for quantitative Data Quality Objectives.

2.7 Special Training Requirements or Certification

The primary training requirements for contractor personnel engaged in field activities are the emergency response and hazardous waste operations training requirements defined in 29 CFR 1910.120. However, specialized training or certification related to environmental data collection might be required if (1) specifically called for in a TO or PR, and (2) identified as necessary by contractor in responding to a TO or PR. In these situations, contractor will address training and certification needs in the site-specific QAPP Addendum or project-specific QAPP. The site-specific QAPP Addendum or project-specific QAPP will identify contractor personnel that meet the special training or certification requirements; provide documentation of the training or certification; and describe how these personnel will be assigned to the project. If contractor personnel do not meet special training or certification requirements, the site-specific QAPP Addendum or project-specific QAPP will briefly describe how the necessary skills will be acquired and applied to the project.

2.8 Documentation and Records

This section describes the requirements for data reporting that are expected of contractor field personnel and laboratories that submit field and laboratory measurement data under EPA contracts. It is the responsibility of the Regional Quality Assurance Manager to ensure that the latest version of the approved Generic QAPP is used. Requirements for data validation reports, data quality assessment reports, or other QC reports that are prepared or compiled by Contractor are not covered here but are described in Sections 4.1, 4.2, 5.1, and 5.2.

Each work plan with SAP and/or and site-specific QAPP Addendum or project-specific QAPP will provide the data reporting requirements for each physical or chemical field and laboratory method that is conducted during the investigation. Data reporting requirements for each field and laboratory method will depend on the DQOs and on the intended uses of the resulting data (see Sections 2.4 and 5.3). Reporting requirements must be clearly specified as part of any request for analytical services (see Section 3.4) and are closely linked to data validation requirements (see Sections 5.1 and 5.2). For example, for most inorganic analytical methods, and for metals in particular, no adequate degree of data validation can be performed without the raw data. Each work plan/SAP with site-specific QAPP Addendum or project-specific QAPP will clearly specify the data that must be reported such that (1) data validation requirements can be satisfied, and (2) attainment of DQOs can be verified.

2.8.1 Laboratory Documentation

The types of data deliverables that are often required for data produced by analytical methods include the following:

- A case narrative, including a statement of samples received, a description of any deviations from the specified analytical method, explanations of data qualifiers applied to the data, and any other significant problems encountered during analysis. The narrative will describe all QC nonconformance experienced during sample analysis, along with the corrective actions taken.
- A table that cross-references field and laboratory sample numbers.
- The chain-of-custody forms pertaining to each sample delivery group or sample batch analyzed.
- A laboratory report showing traceability to the sample analyzed and containing the following

information: project identification; field sample number; laboratory sample number; sample matrix description; dates and times of sample collection, receipt at the laboratory, sample preparation, and analysis; analytical method description and reference citation; individual parameter results with concentration units (including second column results or second detector results, or other confirmatory results, where appropriate); quantitation limits achieved; and dilution or concentration factors.

- The data summary forms and QC summary forms for sample results, surrogate results, blank results, field QC sample results, MS/MSD results, MS results, initial and continuing calibration results, confirmatory results, LCS/LCSD results, and other QC sample results.
- The laboratory control charts.
- The method detection limit and instrument detection limit results.
- The Staged Electronic Data Deliverable (SEDD) is an inter-agency effort to create a generic format for electronic delivery of analytical data for environmental programs. The data deliverable generated by SEDD is an industry-standard Extensible Markup Language (XML) file. A major advantage for laboratories is that SEDD can be implemented in stages. This allows laboratories to meet Electronic Data Deliverable (EDD) requirements for multiple programs without having to overhaul their EDD-producing systems as agency or program needs change. The requirements in http://www.epa.gov/superfund/programs/clp/sedd.htm are for EPA to CLP labs for SEDD / EDD.
- Any deviations from sampling plans or SOPs.

Additional data deliverables may also be required depending on site-specific DQOs or on the particular field or laboratory method of concern.

Contractor Project Managers, in conjunction with the contractor's Quality Assurance Manager, have the primary responsibility for defining project-specific data reporting requirements. These requirements, the turnaround time for receipt of the data deliverables specified, and any project-specific requirements for retention of samples and laboratory records, should be clearly defined in requests for analytical services (see Section 3.4). Subcontractor's laboratory Quality Assurance Managers are responsible for ensuring that all laboratory data reporting requirements in the work plan/SAP, site-specific QAPP Addendum or project-specific QAPP are met.

The contractor will retain all project documents for a time period specified by EPA in the contract or until EPA requests transfer or disposition of the documents.

2.8.2 Field Log Books and Photographic Documentation

A field logbook (prepared by the contractor's Project Manager, subcontractor's Project Manager, or Field Team Leader) will be maintained to record all pertinent activities associated with the sampling event. Entries into the logbook will, at a minimum, be made on a daily basis. The observations and data will be recorded with waterproof ink and kept in a bound, weatherproof field logbook with consecutively numbered pages. Specific sampling information will be recorded on Field Sampling Data Sheets (an example is shown in Appendix B). Each entry into the field logbook will record the following information:

- Names of personnel present during sampling activities.
- Date, time and weather conditions.
- Name, address, and telephone number of the property owner, including private well and municipal well owners/agents.
- Equipment calibration.

- Number, types, location, sampling depth, well depth and screened interval, if available, of the wells sampled.
- Analyses performed in the field and in fixed laboratories.
- QA/QC samples collected.
- Photo log with the number (according to the roll and frame count) or file name if digital camera is used, time and a detailed description of each photo taken to record site conditions during the sampling event.

Changes or deletions in the field logbook or sample collection field sheets will be lined out with a single strike mark and remain legible. Sufficient information will be recorded to allow the sampling event to be reconstructed without relying on the collector's memory. Each day, the person making entries in the field logbook, will sign each page with recorded information, at the end of the day. Anyone making entries in another person's field book will sign and date those entries.

Daily quality control reports (DQCRs) will be completed for each day of sampling activity by the contractor or subcontractor to supplement the information recorded in the field logbook. The DQCRs will be signed and dated by individuals making entries. A copy of the respective daily calibration logbook pages(s) will be attached to each day's DQCR. An example of DQCR is included in Appendix-C. The DQCR will be provided to the EPA Project Manager and included in site assessment reports.

2.8.3 Chain-of-Custody Documentation

All samples collected for shipment to the fixed laboratory during the study will be tracked from the time the samples are collected until laboratory data are issued. Information on the custody, handling, transfer, and transport of samples to the off-site laboratory will be recorded on a chain-of-custody (COC) form as shown in Appendix D. The sampler will be responsible for filling out the COC form. The sampler will sign the COC when relinquishing the samples to anyone else.

A COC form will be completed daily for each set of samples collected, and will contain the following information:

- Sampler's signature and affiliation
- Project name
- Sample identification numbers
- Date and time of collection
- Sample type
- Analyses requested
- Number, size and type of containers
- Preservation method
- Signature of persons relinquishing custody, including date, and time
- Signature of persons accepting custody, including date and time
- Method of shipment

The above elements are included in the latest version of EPA SOP Nos. 2420.4 "Field Chain of Custody for Environmental Samples" and 2420.5 "Identification, Documentation and Tracking of Samples". Laboratory QA/QC records and sample results will be included in the required site assessment report, perhaps as within an appendix. All documents will be kept in the EPA individual site files (hard copy) and available in the public file. All public record files are subject to the EPA Records Retention Plan as outlined in the EPA Quality Management Plan (QMP).

The site-specific task assignments and/or discussions during scope-of-work/sampling strategy meetings will allow EPA to specify the format and content for the data package as well as the desired reporting format.

3.0 DATA GENERATION AND ACQUISITION

This section of the Generic QAPP includes the 10 QAPP elements required by EPA QA/R-5 (EPA, 2000a) to address all aspects of data generation and acquisition. These QAPP elements ensure that appropriate methods for sampling, analysis, measurement and analysis, data collection or generation, data handling, and QC are identified and followed. The 10 QAPP elements related to measurement and data acquisition are:

- Sampling process design (Section 3.1)
- Sampling methods requirements (Section 3.2)
- Sample handling and custody requirements (Section 3.3)
- Analytical methods requirements (Section 3.4)
- Quality control requirements (Section 3.5)
- Inspection and equipment testing, inspection, and maintenance requirements (Section 3.6)
- Instrument and equipment calibration and frequency (Section 3.7)
- Inspection and acceptance requirements for supplies and consumables (Section 3.8)
- Non-direct measurements (data acquisition) requirements (Section 3.9)
- Data management requirements (Section 3.10)

3.1 Sampling Process Design

Sampling activities for each project will be outlined in work plans with SAP information and site-specific QAPP Addendum or project-specific QAPP. These QA/QC documents will summarize the sample network design and rationale, including: the numbers and types of samples to be collected, sampling locations, sampling frequencies, sample matrices, and measurement parameters. Key factors to be evaluated in the sampling process design include:

- Project objectives and decisions to be made.
- Information needed for the decisions and how the information will be used.
- Time and resource constraints.
- Statistical validity and legal defensibility of the data.

Completing this evaluation (1) helps ensure that the analytical results obtained fully support the decisions to be made by data users and (2) maximizes the probability of making a correct decision based on the results.

The sampling network design and rationale will be coordinated with the DQO process described in Section 2.5 of this Generic QAPP. The ultimate use of the data, as defined by the DQO process, will help determine whether grab or composite samples should be collected or whether a probability-based (statistical) data collection design or a nonrandom (judgmental) data collection design should be used.

This section also distinguishes between screening data used for information purposes only (non-critical measurements) and definitive data used to meet project objectives (critical measurements). If field-screening techniques will be used to identify samples for confirmative laboratory analysis, the site-/project-specific QA/QC documents will indicate what techniques will be used and the frequency of confirmative sampling.

For completion of this element, the site-/project-specific QA/QC documents will include a schedule table showing the anticipated start and completion dates of all major milestones, including field sampling events, laboratory analyses, data validation, and report preparation and submittal.

A generic sampling scheme for a RSE indicating an estimate of sample type, location and number of samples is shown in Table 3.1. The actual site-specific number, location and type of samples will be described in the project work plan that must include elements of a SAP and a completed R7 QAPP Addendum Form or project-specific QAPP.

Sampling will follow a biased design in that sampling locations will be from areas deemed most likely to be contaminated. Physical features such as buildings, fences, utilities, roads, lagoons, ponds, surface impoundments, etc., and access to property also will influence selection of sampling locations (based on site reconnaissance prior to sampling).

Table 3.1 – Sample Summary							
No. of Samples	**Matrix**	**Location**	**Purpose**	**Depth or other Descriptor**	**Requested Analysis**	**Sampling Methods**	**Analytical Method**
120	Soil	Residential yards, school yards, parks daycare centers	to confirm XRF readings obtained in the field	0-1 inches	arsenic, barium, cadmium, lead (total)	EPA SOPs 4231.1707 & 4231.2012 4220.03A 4230.19B	EPA Method 3050B/6010B
4	Soil/ Sediment	Stream beds, creeks, ponds, rivers, lagoons, drainage pathways	to determine whether a release to sediments has occurred	0-1 inches	arsenic, barium, cadmium, lead,	EPA SOP 4230.08A	EPA Method 3050B/6010B
2	Soil/Rock	Borrow sources, rock quarries	to determine whether possible borrow source soils and rock are non-contaminated	0-1 inches	arsenic, barium, cadmium, lead, TCLP-arsenic, barium, cadmium, lead	EPA SOPs 4231.2012 & 4231.2017	EPA Method 3050B/1311/6010B
120	Water	Residential wells in the study area	to determine whether a release to drinking water supplies has occurred	N/A	arsenic, barium, cadmium, lead (total and dissolved)	EPA SOP 4230.10A	EPA Method 6020
4	Water	Streams, creeks, ponds, rivers, lagoons, drainage pathways	to confirm whether a release to surface water has occurred	N/A	arsenic, barium, cadmium, lead (total)	EPA SOPs 4230.17A	EPA Method 6020
2	Dust/Wipe	Interior of residences	to determine whether a release within home interiors has occurred	N/A	arsenic, barium, cadmium, lead (total)	EPA SOPs 4231.2011	EPA Method 6020
2	Air	In areas potentially impacted by excavation of contaminated soils, and downwind of site repository	To confirm whether a release to the air pathway has occurred	N/A	lead (total)	NIOSH Method 7300	EPA Method 6010B
QC Samples							
12	Soil	field duplicates	to assess the precision of analytical and sampling methods	0-2 inches	arsenic, barium, cadmium, lead (total)	EPA SOPs 4231.1707 & 4231.2012	EPA Method 3050B/6010B
3	Water	field blanks	to assess field-introduced and lab-introduced contamination	N/A	arsenic, barium, cadmium, lead (total)	N/A	EPA Method 6020
10	Water	field duplicates (residential wells)	to assess the precision of analytical and sampling methods	N/A	arsenic, barium, cadmium, lead (total and dissolved)	EPA SOP 4230.10A	EPA Method 6020

3.1.1 Background Samples

Background samples may be required to compare site conditions to regional or upgradient conditions. Background samples are environmental media samples and not considered "QC samples." Criteria for utilizing background samples vary between regulatory programs. Therefore, background sampling requirements will be determined on a case-by-case basis and specified in the work plan/SAP documents, the site-specific QAPP Addendum or project-specific QAPP.

3.1.2 Site Security

The contractor will provide security at the site to protect the public and the work effort. The security level shall be sufficient to reasonably protect personal property and persons from harm or damage.

3.1.3 Disposal of Contaminated Materials

Investigation-derived waste (IDW) may consist of decontamination fluids, drill cuttings, purge/development water, excess sampled media (e.g., soil, sediment, water, etc.), disposable sampling supplies, and personal protective equipment (e.g., Tyvek/Saranex coveralls, gloves, booties, etc.). Handling of IDW will be performed according to procedures described in Management of Investigation-Derived Wastes During Site Inspections EPA/540/G-91/009 (EPA, 1991a). Attempts will be made to achieve the following goals pertaining to IDW management:

- Leave the site in no worse condition than it existed prior to site activity.
- Remove wastes that pose an immediate threat to human health or the environment.
- Leave wastes on site that do not require off-site disposal or extended containerization.
- Comply with state and federal requirements.
- Minimize the quantity of wastes generated.

Waste disposal for IDW will be dependent upon classification of the waste as either RCRA hazardous or RCRA nonhazardous.

Decontamination of personnel and equipment will be conducted in accordance with the site-specific health and safety plan and EPA Region VII guidelines.

3.1.4 Site Restoration

The contractor will repair or replace material damaged during site assessment activities and restore as near as possible the damaged environment to pre-assessment conditions. At a minimum, the contractor will perform the following:

- Regrading of surface.
- Replacement of soil.
- Replacement of damaged concrete, asphalt or other surface cover.
- Reseed or replant vegetation.

3.2 Sampling Methods Requirements

This Generic QAPP for Lead-Contaminated Sites was prepared to specifically address Superfund investigations on former and active mining, milling and smelter facilities and the associated impacted

areas from the operations of these facilities. Sampling procedures may vary with each project and will be specified in the site-/project-specific QA/QC documents. This section presents information concerning the selection of sampling methods; project-specific sampling method requirements; and requirements for containers, volumes, preservation methods, and holding times for samples that might be commonly required under the contract. Requirements for collecting QC samples are discussed in Section 3.5.

3.2.1 Sampling Methods

Sampling methods and equipment will be selected to meet project objectives. Affected media may include groundwater, surface water, sediments, surface and subsurface soils, wastes, process materials, indoor dust, and air. Field parameters (such as pH, specific conductance, oxidation-reduction potential, temperature, dissolved oxygen content, meteorological parameters, and water elevation) may also be measured to assist in carrying out sampling procedures effectively.

To the extent possible, the Contractor will rely on EPA-approved methods for sample collection and field measurements. EPA-approved sampling methods that are selected for use will be referenced in the site-/project-specific QA/QC documents. Guidance documents containing EPA-approved sampling SOPs include the following:

- OSWER Publication 9360.4-02. January 1991. Compendium of ERT Soil Sampling and Surface Geophysics Procedures. EPA/540/P-91/006. Interim Final. 1991b.
- OSWER Publication 9360.4-03. January 1991. Compendium of ERT Surface Water and Sediment Sampling Procedures. EPA/540/P-91/005. 1991c
- OSWER Publication 9360.4-05. May 1992. Compendium of ERT Air Sampling Procedures. PB92-963406. 1992a.
- OSWER Publication 9360.4-06. January 1991. Compendium of ERT Ground Water Sampling Procedures. EPA/540/P-91/007. 1991d.
- OSWER Publication 9360.4-07. January 1991. Compendium of ERT Waste Sampling Procedures. EPA/540/P-91/008. 1991e.
- OSWER Directive 9360.4-10. December 1995. Superfund Program Representative Sampling Guidance Volume 1: Soil. EPA/540-R-95/141. 1995a.
- OSWER Directive 9360.4-04. May 1992. Compendium of ERT Field Analytical Procedures. 1992b.
- OSWER Publication 9285.7-50. August 2003. Superfund Lead-Contaminated Residential Sites Handbook. 2003.
- Environmental Protection Agency. Pollution Prevention and Toxics. March 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling. EPA 747-R-95-001. 1995b.
- Ground Water Well Samples EPA Region VII. SOP No. 4231.2007.
- Drinking Water Sample Collection. EPA Region VII. SOP No. 4230.10B.
- Geoprobe Operation. EPA Region VII. SOP No. 4232.2050.
- Portable XRF Analyzer, EPA Region VII. SOP No. 4231.1707.
- Chip, Wipe, and Sweep Sampling. EPA Region VII. SOP No. 4231.2011.
- Soil Sampling at Lead-Contaminated Residential Sites. EPA Region VII. SOP No. 4230.19B.
- Interior Dust Sampling at Lead-Contaminated Residential Sites. EPA Region VII. SOP No. 4230.18.
- Waste Pile Sampling. EPA Region VII. SOP 4231.2017.
- X-MET™ 880 Field Portable x-Ray Fluorescence Operating Procedure. EPA Region VII. SOP No. 4232.1707.

- Spectrace 9000 Field Portable X-Ray Fluorescence Operation Procedure. EPA Region VII. SOP No. 4232.1713.
- Surface Water Sampling. EPA Region VII. SOP No. 4232.2013.
- Sediment Sampling. EPA Region VII. SOP No. 4232.2016.
- Protocols for the Region 7 Lead-Contaminated Residential Yard Soil Cleanup Actions Procedures and Sequencing. EPA Region VII. SOP No. 4220.03.

In addition, sampling methods referenced in the Region 7 ESDOQAM will be used. If an EPA-approved sampling method is not available, or a non-standard sampling method is required, the project-specific QAPP or the work plan/SAP and/or site-specific QAPP Addendum will include a procedure for the method.

Collection of groundwater samples from public and private water supply wells will follow the latest version of EPA Region 7 SOP No. 4230.10A: "Drinking Water Sample Collection", or equivalent SOPs supplied by the contractor. SOPs provided by the manufacturer for the direct push sampling probe will be followed by field personnel for soil-gas, soil and groundwater sampling.

Any boreholes created by the direct push probe will be backfilled with bentonite (or equivalent) to the surface to assure that a conduit for contaminated vapors and groundwater is not created at the site. Soil samples will be collected following the latest version of EPA SOP 4231.2012: "Soil Sampling" or equivalent SOPs supplied by the contractor and in accordance with applicable State requirements.

3.2.2 Project-Specific Sampling Methods Requirements

Although this is a Generic QAPP, there are project-specific sampling method requirements that are described in the following section. However, the following items relate to all sampling methods and requirements will be identified or referenced in the site-specific QA/QC document.

- Methods used to select sample locations for all sample matrices.
- Sampling equipment for all sample matrix types and all sampling locations.
- Support facilities with capabilities commensurate with the requirements of the sampling plan.
- Decontamination procedures for all sampling equipment (including drilling equipment). At a minimum, decontamination performed between each sampling point will involve:
    - Rinse sampling equipment with a Trisodium Phosphate or equivalent soap solution.
    - Follow with a potable water rinse.
    - Additional rinse, if required, with potable water or dionized water.
- Procedures for handling and disposing of investigation-derived wastes such as well construction wastes, decontamination fluids, disposable sampling equipment, and so forth, should follow EPA guidance document for Investigation Derived Wastes.
- Procedures for providing unique sample identification numbers that will enable personnel to accurately correlate analytical results and field information with sampling locations and field monitoring stations.

The site-/project-specific QA/QC documents will also identify personnel responsible for corrective action in cases where failures in the sampling or measurement systems occur. In general, corrective actions for field sampling and measurement failures include instrument recalibration, replacement of malfunctioning measurement instruments or sampling equipment, and recollection of samples or repeating measurements.

3.2.2.1 Surface Soil Sampling in Residential Yards, Driveways, Public Areas, and Children Play Areas

Residential properties are defined in the Superfund Lead-Contaminated Residential Sites Handbook (2003) as any area with high accessibility to sensitive populations, and include properties containing single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, day-care centers, community centers, playgrounds, parks, green ways, and any other areas where children may be exposed to site-related contaminated media. This document defines sensitive populations as young children (those under 7 years of age, who are most vulnerable to lead poisoning) and pregnant women. Focus is put on children less than 7 years old because susceptibility of damage during the brain development that occurs through this age range. This is the age range when children are most vulnerable to adverse cognitive effects of lead. Pregnant women are included due to the effects of lead on the fetus. Other EPA guidance and local zoning regulations should also be consulted prior to determining which properties will be treated as residential.

Lead-contaminated residential sites are defined, for the purposes of this Generic QAPP, as sites where lead is the primary contaminant of concern in residential soils. Generally, lead-contaminated sites contain other metals of concern, such as cadmium and arsenic.

It is recommended in the Handbook that when sampling residential lots with a total surface area less than 5,000 square feet (a typical urban lot size), five-point composite samples should, at a minimum, be collected from the front yard and the back yard. The front and back yard composite should be equally spaced within the respective portion of the yard, and should be outside of the drip zone and away from influences of any other painted surfaces. Composites should consist of aliquots collected from the same depth interval. For residential lots with a total surface area greater than 5,000 square feet or with a substantial side yard consult the Handbook for additional sampling strategies.

In each sampling area, a five-aliquot composite sample will be collected from the upper 0-1 inch of soil. Aliquots will be evenly dispersed throughout each sampling area, and will be selected based on the judgment of the sample team. The sample material from a sampling area should be dried, sieved with a No. 60 screen and homogenized. The EPA Technical Review Workgroup (TRW) and American Society for Testing and Materials (ASTM) have issued guidance on sieving (ASTM, 1998; EPA, 2000c). The EPA TRW guidance addresses appropriate sieve size (No. 60) and a method for predicting the concentration in the fine fraction using concentrations measured in unsieved samples. A portion of each homogenized sample from a sampling area will be screened for lead using XRF equipment.

Additional multi-aliquot surface soil samples will also be collected from any play areas, gardens, sand piles, unpaved driveways, and any other areas which may pose a unique risk to children. The number of aliquots collected from these additional areas will depend on their size, but in general the aliquot density will be similar to sampling area sampling. For locations with no residences, the center point of the property will be established and flagged. From the center point, four sampling areas will extend 100 feet in each compass direction, and the aforementioned sampling protocol will be followed (that is, a five-aliquot composite sample will be collected from each sampling area).

To evaluate the accuracy of the XRF equipment, one of every ten samples that are screened with the XRF equipment will be submitted to a lab for confirmation analysis and may include all or some of the following heavy metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. At this time, XRF equipment is not set up to collect screening level data on all the metals listed above, therefore, we only use it to screen for the target metal such as lead. Lead would be the metal that you would have a confirmation analysis performed on. The site manager will decide whether

the sample submitted to the laboratory will be from the same bulk sample or the XRF specimen pack. The site manager will also decide whether the sample should be collected in a public right-of-way or a residential yard. The soil samples submitted to the USEPA laboratory will be analyzed for heavy metals, which include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

See Section 4.3.2 of the Handbook (EPA, 2003) for a sampling design that is based on the assumption that removal of surficial contaminated soils and placement of a cover of clean soil will be protective of human health and the environment. Use EPA Region 7 SOP 4220.03A, Protocols for the Region 7 Lead Contaminated Residential Yard Soil Cleanup Actions Procedures and Sequencing.

3.2.2.2 Sampling of Waste Piles (Mine Tailings)

Samples of tailings should be collected to effectively characterize the tailings pile. The number of locations should be at least five locations in waste piles, but this will depend on the site specific conditions. These samples will be obtained using split spoon samplers installed using DPT and will be collected from the locations where groundwater samples will be collected. Sampling methods and protocols will follow those outlined in EPA Region 7 SOP 4230.7A, Geoprobe Operation. At each location samples from the tailings, it is recommended that samples be collected at vertical intervals of 4 feet from the surface to the base of the tailings (i.e., 0 to 4 feet, 4 to 8 feet, 8 to 12 feet, etc.). A sample from each interval will be selected for analysis. Also from each of the sample locations, a 0-1 inch depth sample should be collected and analyzed for TAL metals. In addition, the 0-1 inch samples should be sieved using a 60-mesh screen. The bulk and the fines will be analyzed for lead with the XRF equipment.

3.2.2.3 Sampling of Indoor Dust

The purpose of dust sampling is to collect data that can be included in the IEUBK model (EPA, 2002c) that will be used to prepare the human health risk assessment. The data must be expressed as a dust lead concentration in order to be used in the model. The IEUBK model does not accept lead loading data. The data from the lead-based paint assessment will be used to determine whether lead based paint is present and will be compared to the EPA criterion for determining whether lead based paint is present (1 mg/cm^2).

The main objectives for collection and analysis of dust samples and analysis of the interior paint in residential homes are to determine the extent on lead contamination in dust from residential homes and determine whether the homes that are sampled for dust also contain lead-based paint. The information collected will be included in the IEUBK model that will be used to prepare the human health risk assessment.

The amount of lead in settled dust samples can be expressed as a lead loading or as a lead concentration. Lead loading is the weight of lead per area sampled and the typical units are $\mu g/ft^2$ (EPA, 1995a). Lead concentration is the weight of lead per weight of sample and is typically reported as ug/g (EPA, 1995a). Vacuum dust collection is able to generate both lead loading and lead concentration results.
In each residence, it is anticipated that three-dust samples will be collected. Since each residence will have a different floor plan and furniture arrangement, it will not be possible to predetermine the exact sample locations. The following is a list of the three general sample areas with a description of sample location criteria based on each residence's characteristics.

Entry Way: A vacuum sample will be collected from the most frequently used entry way to the residence. The sample location must be at least 1 meter (3 feet) away from the door (CS_3, Inc., 1998). If there is an option between a hard floor surface and a carpeted floor surface, the hard floor surface area will be

chosen over the carpeted surface due to the potential for better sample collection on a hard floor surface. The sample will then be collected using the appropriate vacuum method for the floor type.

Floor: A floor sample will be collected from the most commonly used room in the residence other than a bedroom. The selection of the sample location is based on whether or not a child or children live at the residence. **Children are defined as less than 7 years old.** If children live at the residence, the room, other than the bedroom, where the children spend the most time on the floor in the room will be chosen. If no children live at the residence, the room, other than the bedroom, where residents spend the most time will be chosen. Sample location will be based on the floor type(s) in the room. If there is a hard floor surface and a carpeted floor surface in the room, the hard floor surface will be sampled. A sample location that is not in the main walking pathway of the room, and is also large enough to accommodate the sampling requirements, will be chosen as the sample location. The sample will then be collected using the appropriate vacuum method for the floor type.

Bedroom: A sample will be collected form one bedroom in the residence. The selection of the sample location is based on whether or not a child or children live at the residence. If there is a child living at the residence, their bedroom shall be selected. If there is more than one child living at the residence, -youngest child's bedroom shall be selected. If there are no children living at the residence, the bedroom where the most time is spent shall be selected. If a child's room is selected, regardless of floor type, the sample location shall be chosen based on where the child's play area is in the room or where they spend the most time on the floor in the room. If an adult bedroom is selected, the sample shall be collected based on floor type. In that bedroom, if there is a hard floor surface and a carpeted floor surface in the room, the hard floor surface will be sampled. Once the sample location has been determined, the sample will then be collected using the appropriate vacuum method for the floor type. All dust samples collected during the investigation will be sent to the EPA Region VII laboratory for analysis of TAL metals.

3.2.2.3.1 Vacuum Sampling

This method of dust sampling is suitable for the collection of settled dust samples from both hard and smooth or highly textured surfaces, such as brickwork and rough concrete, and soft, fibrous surfaces, such as upholstery and carpeting. This method produces samples for lead determination results in both loading ($\mu g/ft^2$) and concentration ($\mu g/g$).

Equipment for sampling is described in the American Society for Testing Materials (ASTM) Standard D5438-05 (ASTM, 2005). A minimum volume of dust sample may be required by the laboratory to analyze the sample for metals. This minimum volume of dust sample should be included in the site specific QAPP Addendum or project-specific QAPP.

3.2.2.3.2 Carpet Floor Sampling

Dust samples from carpeted floors will be collected in accordance with Paragraph 11.1 of ASTM D5438-05. Dimensions of the sampled area must be noted on the Field Sheet. The dust sample should be placed in a clean 4 oz wide mouth sample jar to be sieved and weighed. A 60-mesh sieve will be used to sieve the dust sample.

3.2.2.3.3 Hard Surface Floor Sampling

Dust samples from carpeted floors shall be collected in accordance with Paragraph 11.2 of ASTM D5438-05 (ASTM, 2005). Dimensions of the sampled area must be noted on the Field Sheet. The dust sample should be placed in a clean 4 oz wide mouth sample jar and taken to be sieved and weighed. A 60-mesh sieve will be used to sieve the dust sample.

3.2.2.4 Interior and Exterior Lead-Based Paint Assessment Paint

Lead-based paint (LBP) screening will be conducted on the interior and exterior of homes at properties where dust samples are collected. The purpose of the LBP screening is to determine whether LBP is present in the home. The LBP screening performed is not intended to be as comprehensive as a LBP inspection or a lead hazard screen as defined in the EPA regulation at 40 CFR 745.227.

Lead screening readings will be taken using XRF equipment. The XRF equipment will provide LBP data in milligrams per square centimeter (mg/cm^2). The unit is capable of analyzing LBP to less than 1 mg/cm^2. Forms for recording XRF readings in homes, documenting calibration checks, and recording substrate correction values, if required, are presented in ASTM D5438-05 (ASTM, 2005). There is considerable variation among XRF brands and models in their ability to accurately measure lead based paint which has been over painted with several coats of latex paint. This should be considered when selecting a particular XRF for lead based paint measurements.

The following procedures should be followed during the LBP screening assessments:

- Conduct an initial visual inspection of the exterior walls of the home and the interior painted surfaces in rooms where dust samples are collected and assess whether significant of chipping, peeling and/or deteriorating paint is present.
- If significant deteriorating painted surfaces are observed on the exterior walls of the residence, each of the four walls of the residence will be analyzed for LBP using XRF equipment. If significant deteriorating painted surface are observed in the interior rooms where the dust samples are collected, each of the four walls in the room and a minimum of two window sills will be analyzed for LBP using XRF equipment. The XRF readings will be taken at the location of the deteriorating painted surfaces.
- If deteriorating painted surfaces are not observed on the exterior walls of the residence, each of the four walls of the residence will be analyzed for LPB using XRF equipment. If deteriorating paint is not found observed in the rooms where dust sampled are collected, XRF readings will be taken from each of the four walls and a minimum of two window sills.
- The sampling team will document the general description of the interior walls and window sills in the rooms where XRF readings are taken.

3.2.2.5 Speciation and Apportionment Sampling

Speciation analysis identifies the source(s) of contamination. Apportionment analysis quantifies the relative contributions of each source. Such analyses are usually performed by a national expert working under a subcontract for an EPA prime contractor. The subcontracted researcher will provide their own preferences for sample collection and preservation. Be sure to consult with the researcher before collecting samples for Speciation and Apportionment.

3.2.3 Sample Container, Volume, Preservation, and Holding Time Requirements

When appropriate, each project work plan with a SAP and a R7 QAPP Addendum Form or project-specific QAPP (for SA, ISA and RSE activities) will specify the required sample volume, container type, preservation technique, and holding time for each analysis to be conducted on each sample matrix. This information will most likely be presented in tabular form.

3.3 Sample Handling and Custody Requirements

Each sample collected by the contractor under this contract must be traceable from the point of collection through analysis and final disposition to ensure sample integrity. Sample integrity helps ensure the legal defensibility of the analytical data and subsequent conclusions. The team will use standard EPA procedures to identify, track, monitor, and maintain chain-of-custody for all samples. Chain-of-custody records will establish the documentation necessary to trace sample possession from collection through final disposition. Each person that has custody at any time throughout the sample history is held responsible for maintaining proper documentation and control measures. A sample is under a person's custody if it:

- Is in that person's possession.
- Is in that person's view after being in his or her possession.
- Is in that person's possession and he or she places it in a secured location.
- Is placed by that person in a designated secure area.

Samples will be handled in accordance with the following national guidance documents and EPA Region VII SOPs:

- Field Chain of Custody for Environmental Samples. EPA Region VII. SOP No. 2420.04C.
- Identification, Documentation, and Tracking of Samples. EPA Region VII. SOP No. 2420.05D.
- Sample Container Selection, Preservation, and Holding Times. EPA Region VII. SOP No. 2420.06E.
- Sample Receipt & Log-In. EPA Region VII. SOP No. 2420.01E.
- RLB Procedures for Preparation of Field Sheets and Tags. EPA Region VII. SOP No. 2420.13C

Field and laboratory chain-of-custody procedures are discussed in the next section.

3.3.1 Field Chain-of-Custody Procedures

All projects conducted by the contractor under this contract will follow sample and document control procedures, sample and evidence identification procedures, field records requirements and procedures, and chain-of-custody procedures outlined in the latest version of EPA Region 7 SOPs 2420.04C and 2420.05D. Samples will be packaged and labeled for shipment in compliance with current U.S. Department of Transportation (DOT) and International Air Transport Association (IATA) dangerous goods regulations. Any additional requirements stipulated by the overnight shipping firm will be followed.

3.3.1.1 Field Procedures

The sample packaging and shipment procedures summarized below will ensure that the samples arrive at the laboratory with the chain-of-custody intact. All chain-of-custody forms should be filled out in ink. Certain information required on the chain-of-custody form such as names of samplers, and date and time of sample collection are self-explanatory. The following additional information will be entered on the chain-of-custody form:

- The Contractor task order number will be entered in the space entitled "project number."
- A description of where the sample was taken will be included in the space entitled "station location" (for example, southwest corner of drum storage area).
- The target parameters and analytical method will be entered in the space entitled "analysis required" (for example, metals, SW846 Method 6010B).

The contractor will use EPA Region 7 SOP No. 2420.06E, "Sample Container Selection, Preservation, and Holding Times", or equivalent SOPs. The contractor field personnel will follow the steps outlined below to prepare the samples and custody documents:

- Immediately after sample collection, sample containers will be labeled with the appropriate identifiers, and clear tape will be placed over the labels to preserve label integrity.
- The samples will be placed in Ziploc™ plastic bags and which will then be immediately placed on ice in cooler containing double-sealed bags of ice and maintained at 4° C.
- Glass containers will be wrapped in bubble pack and placed in Ziploc™ plastic bags. Samples will be transported or shipped to the laboratory in time so that the analysis can be performed before the holding times are exceeded.
- Prior to shipping, the chain-of-custody forms, air bills, and all other relevant documents will be completed. Chain-of-custody forms will be sealed in plastic bags and taped to the inside of the cooler lid. Cushioning material, consisting of bubble-wrap, will be placed in the cooler.
- A temperature blank consisting of a jar or vial containing water will be included in every cooler to be used by the laboratory to determine the cooler temperature at the time of sample receipt.
- The shipping cooler will then be sealed with tape and custody seals in a manner that will indicate whether the cooler was opened. The preferred procedure includes placement of custody seals at diagonally opposite corners of the cooler. The custody seals will be covered with clear plastic tape or strapping tape.
- Coolers will remain in a secured area or in view of the sampler until it is properly sealed for shipment to the laboratory.

During field sampling activities, traceability of the sample must be maintained from the time the samples are collected until laboratory data are issued. Information on the custody, transfer, handling, and shipping of samples to the off-site laboratory will be recorded on a chain-of-custody (COC) form. Details of the chain of custody requirements are discussed in Section 2.8.3.

Contractor will utilize the following the latest version of EPA Region 7 SOPs, or similar and equivalent SOPs for handling and tracking samples:

- 2420.04C, "Field Chain-of-Custody for Environmental Samples."
- 2420.05D, "Identification, Documentation and Tracking of Samples."
- 2420.006E, "Sample Container Selection, Preservation, and Holding Times."
- 2420.11D, "Preparation of Aqueous and Soil Trip Blanks."
- 2420.12C, "Preparation of Chemical Preservatives for Aqueous Environmental Samples."
- 2420.13C, "RLAB Procedures for Preparation of Field Sheets and Tags."

The field sampler is personally responsible for the care and custody of the samples until they are transferred to other Contractor personnel or properly dispatched to an overnight carrier or directly to a laboratory. As few people as possible should handle the samples to prevent loss, breakage, or potential contamination. When transferring possession of the samples, the individuals relinquishing and receiving

the samples sign, date, and note the time of transfer on the chain-of-custody form. Commercial carriers are not required to sign off on the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody seals remain intact.

3.3.1.2 Field Logbooks

Field logbooks provide the means of recording all data collection activities performed. Logbook entries will be described in as much detail as possible so that a particular situation can be reconstructed without relying on memory. Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel but will be stored in the secure location when not in use. Each logbook will be identified by a site-specific document number. The title page of each logbook will contain the following information:

- Person to whom the logbook is assigned.
- Logbook number.
- Project name.
- Project start and end dates.

All logbook entries will be made in ink and no erasures will be made. If an incorrect entry is made, the incorrect information will be crossed out with a single strike mark that will be initialed and dated by the person making the correction. Logbook entries will contain a variety of information. The beginning of each entry will note the date, start time, weather, name of all team members' present, facility visitors present and the purpose of their visit, level of personal protection used, and signature of the person making the entry.

Whenever a sample is collected or a measurement is taken, a detailed description of the sampling or measurement location, which may include GPS, compass and distance measurements, will be recorded in the logbook. The number and description of any photographs taken of the location will also be noted. All equipment used to take measurements will be identified along with the date of equipment calibration. The equipment used to collect samples will be noted along with the time of sampling, sample description, depth at which the sample was collected, sample volume, number of containers, and sample preservation method. The number, type, and location of QC samples will also be noted in the logbook.

3.3.2 Laboratory Chain-of-Custody Procedures

Custody procedures must be followed in the laboratory from sample receipt until the sample is discarded. The procedures required for this contract are those required by the EPA Contract Laboratory Program (CLP) Statements of Work (SOW). These procedures are described in this section.

The laboratory should designate a specific person as the sample custodian, with an alternate designated to act in the custodian's absence. The custodian will receive all incoming samples and indicate receipt by signing the accompanying custody forms and retaining copies of the signed forms as permanent records. Once the sample transfer process is complete, the laboratory is responsible for maintaining internal logbooks, lab tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory sample custodian will record all pertinent information concerning the sample, including the persons delivering and receiving the sample, the date and time received, the method by which the sample was transmitted to the laboratory, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification number, and any unique laboratory identification number associated with the sample.

The laboratory must provide a secure storage area, restricted to authorized personnel, for all samples. The custodian will ensure that samples that are heat- or light-sensitive, radioactive, have other unusual physical characteristics, or require special handling are properly stored and maintained prior to analysis. Only the custodian can distribute samples to laboratory personnel authorized to conduct the required analyses. Laboratory analytical personnel are responsible for the care and custody of the sample upon receipt. These personnel must be prepared to testify that the sample was in their custody at all times from the moment they received it from the custodian until the time that the analyses were completed.

At the completion of sample analysis, any unused portion of the sample, together with all identifying labels, must be returned to the custodian. The returned tagged sample should be retained in secure storage until the custodian receives permission to dispose of the sample. Sample disposal will occur only on the order of the laboratory director, in consultation with EPA or contractor, or when it is certain that the information is no longer required or the samples have deteriorated. Likewise, tags and laboratory records will be maintained until the information is no longer required and final disposition is ordered by the laboratory director, in consultation with EPA or the contractor.

3.4 Analytical Methods Requirements

The source of analytical services to be provided will in part be determined by DQOs, the intended use of the resulting data, and TO or PR-specific requirements and constraints such as quick turnaround of data. The work plan and QA/QC documents or the project-specific QAPP will identify the specific laboratory that has been selected to provide analytical services.

This section of the Generic QAPP outlines the procedures that the contractor will use to identify and select field and laboratory analytical methods that are consistent with DQOs.

3.4.1 Field Analytical Methods

Whenever possible, the contractor will use EPA-approved methods for field measurements and analyses. For example, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, and SW-846 may be used to determine field parameters such as pH, specific conductance, dissolved oxygen, and temperature. For situations where an EPA-approved or standard method does not exist, or where a modification of an EPA-approved method is used, the contractor will include appropriate SOPs in the project work plan and site-specific QAPP Addendum or project-specific QAPP. The SOPs must contain method performance study information to confirm the performance of the method for each applicable matrix. If previous performance studies are not available, they must be developed during the project and included as a part of the project results.

3.4.2 Laboratory Analytical Methods

To select appropriate methods for sample preparation, cleanup, and analysis, the contractor will consider the specific parameters of interest, sample matrices, and minimum detectable concentrations needed to accomplish project DQOs. Whenever possible, the contractor will select methods from SW-846 or from the Contract Laboratory Program Statements of Work for Organics and Inorganics Analyses. If these sources do not include an analytical method consistent with DQOs, the contractor will review other EPA-approved methods such as those specified in SW-846. Table 3.2 includes a listing of some of the more commonly used analytical methods found in the SW-846 compendium of methods.

Table 3.2 EPA Approved Methods					
Matrix	**Location**	**Purpose**	**Requested Analysis**	**Sampling Methods**	**Analytical Method**
Soil	Residential yards, school yards, parks daycare centers	to confirm XRF readings obtained in the field	arsenic, barium, cadmium, lead (total)	EPA SOPs 4231.1707 & 4231.2012 EPA SOPs 4220.03A 4230.19B	EPA Method 3050B/6010B & 6200
Soil/ Sediment	Stream beds, creeks, ponds, rivers, lagoons, drainage pathways	to determine whether a release to sediments has occurred	arsenic, barium, cadmium, lead,	EPA SOP 4230.08A	EPA Method 3050B/6010B
Soil/Rock	Borrow sources, rock quarries	to determine whether possible borrow source soils and rock are non-contaminated	arsenic, barium, cadmium, lead, TCLP-arsenic, barium, cadmium, lead	EPA SOPs 4231.2012 & 4231.2017	EPA Method 3050B/1311/6010B
Water	Residential wells in the study area	to determine whether a release to drinking water supplies has occurred	arsenic, barium, cadmium, lead (total and dissolved)	EPA SOP 4230.10A	EPA Method 6020
Water	Streams, creeks, ponds, rivers, lagoons, drainage pathways	to confirm whether a release to surface water has occurred	arsenic, barium, cadmium, lead (total)	EPA SOPs 4230.17A	EPA Method 6020
Dust/Wipes	Interior of residences	to determine whether a release within home interiors has occurred	arsenic, barium, cadmium, lead (total)	EPA SOPs 4231.2011	EPA Method 6010B
Air	In areas potentially impacted by excavation of contaminated soils, and downwind of site repository	To confirm whether a release to the air pathway has occurred	lead (total)	NIOSH Method 7300	EPA Method 6010B
QC Samples					
Soil	field duplicates	to assess the precision of analytical and sampling methods	arsenic, barium, cadmium, lead (total)	EPA SOPs 4231.1707 & 4231.2012	EPA Method 3050B/6010B
Water	field blanks	to assess field-introduced and lab-introduced contamination	arsenic, barium, cadmium, lead (total)	N/A	EPA Method 6020
Water	field duplicates (residential wells)	to assess the precision of analytical and sampling methods	arsenic, barium, cadmium, lead (total and dissolved)	EPA SOP 4230.10A	EPA Method 6020

When EPA-approved methods are not available or appropriate for project-specific requirements, other recognized standard analytical methods, such as those published by the ASTM or the National Institute for Occupational Safety and Health (NIOSH), may be used.

The published methods mentioned are updated at various time intervals. Hence, both old and new versions of these published methods exist, and future updates of these published methods will also be produced. Unless otherwise stated, laboratories conducting work under the EPA Environmental Services contract will use the most current version of any specified analytical method.

The EPA Analytical Service Request (ASR) form will be used to schedule sample analyses to be conducted by the EPA Region 7 Laboratory.

Laboratory analytical methods will vary with each investigation conducted under the contract and should be identified in the site-/project-specific QA/QC documents. When laboratory analyses will be conducted

exactly according to the most recent EPA-approved methods listed above, the QAPP will reference the appropriate method. However, for some EPA-approved methods, it may be necessary to include additional information in the site-/project-specific QA/QC documents. For example, some methods found in SW-846 allow the user to specify digestion methods for soil samples. The specific options selected will be included in the Analytical Service Request form and in the site-/project-specific QA/QC documents.

On rare occasions, project-specific conditions might require the use of an analytical method that is either a modification of an EPA-approved method or is not an EPA-approved or standard method. These methods will typically be provided by the laboratory performing the method and will include a detailed description of sample preparation, instrument calibration, sample analyses, method sensitivity, associated QA/QC requirements, and acceptance criteria. The laboratory or method developer must provide method performance study information to confirm the performance of the method for each applicable matrix; if previous performance studies are not available, they must be developed during the project and included as part of the project results.

If an analytical system fails, the contractor's Quality Assurance Manager will be notified and corrective action will be taken. In general, corrective actions will include stopping the analysis, examining instrument performance and sample preparation information, and determining whether instrument recalibration and re-preparation and reanalysis of samples are warranted.

3.5 Quality Control Requirements

Quality Assurance/Quality Control (QA/QC) samples will be collected to evaluate the precision and accuracy of the mobile and fixed laboratory analysis.

Various kinds of field and laboratory QC samples and measurements will be used to verify that analytical data meet project-specific QA objectives. Field QC samples and measurements will be used to assess how the sampling activities and measurements influence data quality. Similarly, laboratory QC samples will be used to assess how a laboratory's analytical program influences data quality. The work plan with site-specific QAPP Addendum or project-specific QAPP will provide a description (usually in table format) of the QC samples to be analyzed during the investigation for (1) each field and laboratory environmental measurement method and (2) each sample matrix type.

This section of the Generic QAPP provides definitions and typical collection and analysis frequencies for common field and laboratory QC samples and measurements. In addition, this section outlines the procedures used to assess field measurements, laboratory data, and common data quality indicators.

3.5.1 Field Quality Control Requirements

Field QC samples will be collected and analyzed to assess the quality of data generated from sampling activities. These samples may include trip blanks, field blanks, equipment rinsate blanks, field duplicates, field split samples, matrix spike (MS) samples, matrix spike duplicate (MSD) samples, and matrix duplicate samples. Field QC measurements may include field replicate measurements and checks of instrument responses against QC standards.

Trip blanks, field blanks, and equipment blanks should be free of contaminants. If contaminants are detected, the data from the environmental samples may be qualified as per data validation procedures discussed in Section 5.

Trip blanks are used to assess the potential for sample contamination during handling, shipment, and storage. Trip blanks will consist of VOC analysis vials filled with ASTM Type II water at the laboratory. The trip blanks are sealed and transported to the field; kept with empty sample bottles and then with investigative samples throughout the field effort; and returned to the laboratory for analysis with the investigative samples. Trip blanks are never opened in the field. One trip blank will be included within every shipping cooler of liquid samples to and from the field to be analyzed for VOCs to detect any cross-contamination during handling and transport.

Field blanks are samples of the same or similar matrix as the actual investigative samples that are exposed to the sampling environment or equipment at the time of sampling. They are used to assess contamination resulting from ambient conditions. Field blanks are generally not required for solid matrices but may be collected on a case-by-case basis.

Equipment rinsate blanks are collected when sampling equipment is used. These blanks assess the cleanliness of sampling equipment and the effectiveness of equipment decontamination. Equipment rinsate blanks are collected by pouring analyte-free water over surfaces of cleaned sampling equipment that contact sample media. Equipment rinsate blanks are collected after sampling equipment has been decontaminated but prior to being reused for sampling. Equipment rinsate blanks are typically collected for each type of decontaminated sampling equipment.

Field duplicate samples are independent samples collected as close as possible in space and time to the original investigative sample. Immediately following collection of the original sample, the field duplicate sample is collected using the same collection method. Care should be taken to collect the field duplicate sample as close to the location of the original sample as possible. Field duplicate samples can measure how sampling and field procedures influence the precision of an environmental measurement. They can also provide information on the heterogeneity of a sampling location. One field duplicate groundwater sample per site will be collected (sequentially) at a frequency of one for every 10 investigative samples of the same matrix type. A minimum of one field duplicate sample should be taken for each matrix sampled, even if less than 10 samples are collected for the applicable matrix. Field duplicates will be analyzed at the fixed laboratory for the same parameter as the primary sample analyzed at the on-site lab. A duplicate soil sample per site will be collected from the same sampling spoon as the primary sample. These results will be used to evaluate the representativeness of the sample.

Field split samples are usually a set of two or more samples taken from a larger homogenized sample. The larger sample is usually collected from a single sampling location, but can also be a composite sample. Field split samples can be sent to two or more laboratories and are used to provide comparison data between the laboratories. Regulatory agencies involved in a project may request that field split samples be collected to monitor how closely laboratories are meeting site-/project-specific QA objectives.

MS/MSD samples are often collected for analysis by inorganic methods. Solid MS/MSDs usually require no extra volume. MS and matrix duplicate samples are typically collected for inorganic analysis. The MS sample and matrix duplicate sample are each a single sample, usually collected from a single location at double the normal sample volume. In the laboratory, MS/MSD samples and MS samples are spiked with known amounts of analytes. Matrix duplicate samples are not spiked. Analytical results of MS/MSDs are used to measure the precision and accuracy of the laboratory inorganic analytical program and MSs are used to measure the accuracy of the inorganic analytical program. Matrix duplicate sample are used to measure the precision of the inorganic analytical program. Each of these QC samples is typically collected and analyzed at a frequency of one for every 20 investigative samples per matrix. QC checks for field measurements will consist primarily of initial and continuing calibration checks of field equipment. When applicable, QC check standards independent of the calibration standards will be used to check equipment performance. For example, when checking the accuracy of field equipment such

as pH meters, a standard buffer solution independent of the calibration standards may be used. Precision of field measurements will usually be checked by taking replicate measurements. To the extent possible, Contractor will use EPA-approved field methods. If approved methods are not available, Contractor SOPs will be referenced in the project work plan and/or site-/project-specific QA/QC documents. The types and frequencies of field QC measurements and the QC limits for these measurements will be specified in the project's QA/QC documents.

3.5.2 Laboratory Quality Control Requirements

The laboratory QA/QC elements including laboratory spikes and blanks will be performed in accordance with the latest versions for EPA analytical methods SOPs and EPA Region 7 SOP No. 2430.12E, "Regional Laboratory Quality Control Policy", or equivalent SOP supplied by contractor. The EPA Project Manager will be responsible for verifying that copies of the referenced SOPs are available and that the SOPs are being followed by conducting periodic site visits to the field, mobile lab and fixed laboratory. When the contractor has identified the subcontractor for the mobile and fixed laboratory, copies of the laboratory's SOPs will be acquired and added as an addendum to the site-/project-specific QAPP.

All water samples will require fixed laboratory confirmation. In general, fixed laboratory analysis will be performed for all critical samples needed to establish primary targets, support attribution, and/or otherwise used for site scoring.

All laboratories that perform analytical work under this EPA environmental services contract must adhere to a QA program that is used to monitor and control all laboratory QC activities. Each laboratory must have a written QA manual that describes the QA program in detail. The laboratory Quality Assurance Manager is responsible for ensuring that all laboratory internal QC checks are conducted according to the laboratory's QA manual, the requirements of this Generic QAPP, and any additional requirements included within a project-specific QAPP.

Many of the laboratory QC procedures and requirements are described in EPA-approved analytical methods, laboratory method SOPs, and method guidance documents. However, if laboratory QC requirements are not specified in an analytical method, or if additional requirements beyond those included in an analytical method are necessary to ensure that project QA objectives and DQOs are met, the project-specific QAPP will identify the additional laboratory QC checks that must be performed. The following types of information should be included:

- Laboratory analytical methods to which the internal QC checks applies.
- Complete procedures for conducting the internal QC check.
- QC samples and QC measurements involved in the internal QC check.
- Complete collection and preparation procedures for the QC samples.
- Spiking analytes and concentrations.
- Control limits for the internal QC check.
- Corrective action procedures to be followed if the internal QC checks are not done properly or results are outside control limits.

Laboratory QC procedures and requirements may include the preparation and analysis of laboratory control samples (LCS), method blanks, MS and MSD samples, surrogate spikes, and standard reference materials or independent check standards. QC checks that are most frequently required are discussed in the following sections.

3.5.2.1 Laboratory Control Samples

Laboratory control samples (LCS) are well-characterized, laboratory-generated samples that will be used to monitor the laboratory's day-to-day performance of analytical methods. LCSs can include laboratory duplicate samples, laboratory spike samples, or method blanks. The results of LCS analyses are compared to well-defined laboratory control limits to determine whether the laboratory system is in control for the particular method. If the system is not in control, corrective action is implemented. Corrective action can include stopping the analysis; examining instrument performance or sample preparation and analysis information; and determining whether re-preparation or reanalysis is warranted.

3.5.2.2 Method Blanks

Method blanks, also known as analytical process or preparation blanks, are analyzed to assess the level of background interference or contamination that exists in the analytical system and that may lead to the reporting of elevated concentration levels or false-positive or false-negative data. One method blank is typically analyzed for every 20 samples processed by the analytical system. For batches smaller than 20 samples, one method blank is analyzed with every batch of samples processed.

A method blank consists of reagents specific to the analytical method that are carried through every aspect of the analytical procedure, including sample preparation, cleanup, and analysis. Results of the method blank analysis are evaluated in conjunction with other QC information to determine the acceptability of the data generated for that batch of samples. Ideally, the concentration of target analytes in the method blank should be below the method or instrument detection limit for that analyte. For some common laboratory contaminants, detection of a higher concentration may be allowed.

If the blank for any analysis is not within control limits, the source of contamination must be investigated, and appropriate corrective action must be taken and documented. Investigation includes an evaluation of the data to determine the extent and effect of the contamination on sample results. If a method blank indicates analytes above the method or instrument detection limits, an investigation should be conducted to determine whether any corrective action could eliminate an ongoing source of target analytes.

Refer to the individual analytical methods and the appropriate data validation guidance documents for detailed information regarding blank frequencies of analyses, acceptance criteria for blanks, and corrective actions for out-of-compliance blank results (see Section 5.2).

3.5.2.3 Matrix Spikes, Matrix Spike Duplicates, and Matrix Duplicates

A matrix spike (MS) is an environmental sample to which known concentrations of target analytes have been added. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis. If the number of target analytes is large, target analytes are divided into two to three spike standard solutions. Each spike standard solution must be alternately used. The MS, in addition to an unspiked aliquot, is taken through the entire analytical procedure, and the recovery of the analytes is calculated. Results are expressed as percent recovery (%R). One MS is typically analyzed for every 20 investigative samples prepared in one batch for inorganic analyses.

An MS/MSD is an environmental sample divided into two separate aliquots, each of which is spiked with known concentrations of target analytes. The two spiked aliquots, in addition to an unspiked sample aliquot, are analyzed separately, and the results are compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as relative percent difference (RPD) and percent recovery (%R) and are compared to control limits that have been established for each analyte. If

results fall outside control limits, corrective action must be performed. One MS/MSD is typically analyzed for every 20 investigative samples prepared in one batch for organic or inorganic analyses.

A matrix duplicate sample is an environmental sample divided into two separate aliquots that are analyzed separately. The results are compared to determine the effects of the matrix on analytical precision. Results are expressed as RPD and are compared to control limits established for each analyte. If results fall outside control limits, corrective action must be performed. One matrix duplicate sample is typically analyzed for every 20 investigative samples prepared in one batch for inorganic analyses.

3.5.2.4 Standard Reference Materials and Independent Check Standards

Standard reference materials and independent check standards can be used to evaluate the accuracy of an analytical system. The source, traceability, certification of purity, and concentration of these materials and standards must be documented. The "true" known concentrations of standard reference materials and independent check standards is then compared to results obtained from the analytical system to evaluate the accuracy of the system.

3.5.3 Common Data Quality Indicators

This section describes how QA objectives for precision, accuracy, completeness, and sensitivity are measured, calculated, and reported. For some investigations, additional equations might also be needed (for example, equations for calculating mass balances, emission rates, and confidence ranges).

3.5.3.1 Precision

Precision of many analyses is assessed by comparing analytical results of MS/MSD sample pairs for organic and inorganic analyses, field duplicate samples, field split samples, laboratory matrix duplicate samples, and replicate measurements. If calculated from two measurements, precision is normally measured as RPD:

$$RPD = \left[\frac{2\ x\ (C_1 - C_2)}{(C_1 + C_2)} \right] \times 100$$

where: RPD = Relative percent difference
C_1 = Larger of the two observed measurement values
C_2 = Smaller of the two observed measurement values

For field measurements such as pH, where the absolute variation is more appropriate, precision is often reported as the absolute range (D) of duplicate measurements:

$$\%D = |m_1 - m_2|$$

where: D = Absolute range
m_1 = First measurement value
m_2 = Second measurement value

3.5.3.2 Accuracy

The accuracy of many analytical methods is assessed using the results of MS/MSD samples for organic and inorganic analyses, MS samples for inorganic analyses, surrogate spike samples, laboratory control samples, standard reference materials, independent check standards, and measurements of instrument responses against zero and span gases. For measurements where spikes are used, %R is often calculated as a measure of accuracy:

$$\%R = 100 \times \left[\frac{(S - U)}{C_{sa}} \right]$$

where: $\%R$ = Percent recovery
S = Measured concentration in spiked aliquot
U = Measured concentration in unspiked aliquot (usually equals zero for surrogate spikes)
C_{sa} = Actual concentration of spike added

When a standard reference material (SRM) is used, the following equation is often used to calculate %R:

$$\%R = 100 \times \left[\frac{C_m}{C_{srm}} \right]$$

where: $\%R$ = Percent recovery
C_m = Measured concentration of SRM
C_{srm} = Actual concentration of SRM

For field measurements such as pH, accuracy is often expressed in terms of bias (B) and is calculated as follows:

$$B = M - A$$

where: M = Measured value of SRM
A = Actual value of SRM

3.5.3.3 Completeness

Completeness is defined as follows for most measurements:

$$\%C = 100 \times \left[\frac{V}{n} \right]$$

where: $\%C$ = Percent completeness
V = Actual number of measurements judged valid (the validity of a measurement result is determined by judging its suitability for its intended use)
n = Total number of measurements planned to achieve a specified level of confidence in decision making

3.5.3.4 Sensitivity

The achievement of method detection limits (MDL) depends on instrument sensitivity and matrix effects. Therefore, it is important to monitor the instrument sensitivity to ensure data quality and to ensure that

analyses meet the QA objectives for sensitivity stated in the project QA/QC documents. Method sensitivity is typically evaluated in terms of the MDL and is defined as follows for many measurements:

$$MDL = t(n-1,1-x=0.99)s$$

where: MDL = Method detection limit
s = Standard deviation of the replicate analyses
$t_{(n-1,1-\square=0.99)}$ = Student's t-value for a one-sided 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom
n = Number of measurements
x = Statistical significance level

3.6 Instrument and Equipment Testing, Inspection, and Maintenance Requirements

This section outlines testing, inspection, and maintenance procedures for field equipment and instruments and for laboratory instruments. This section includes general requirements applicable to both field and laboratory equipment as well as field-specific and laboratory-specific requirements.

3.6.1 General Requirements

General requirements for testing, inspection, and maintenance procedures for the Environmental Services contract are as follows. Testing, inspection, and maintenance methods and frequency will be based on the type of instrument; its stability characteristics; the required accuracy, sensitivity, and precision; it's intended use, considering project-specific DQOs; manufacturer's recommendations; and other conditions affecting measurement or operational control. For most instruments, preventive maintenance is performed according to procedures and schedules recommended in (1) the instrument manufacturer's literature or operating manual or (2) SOPs associated with particular applications of the instrument. In such cases, the project work plan and QA/QC documents or site-/project-specific QAPPs will reference these documents for the testing, inspection, and maintenance procedures and schedules to be used. The site-specific QAPP Addendum or project-specific QAPP will also reference these documents and/or will provide in the body of the site-specific QAPP Addendum or project-specific QAPP, how the availability of critical spare parts will be assured and maintained for all instruments and applications used for the project.

In some cases, testing, inspection, and maintenance procedures and schedules may differ from the manufacturer's specifications or SOPs. This can occur when a field instrument is used to make critical measurements or when the analytical methods associated with a laboratory instrument require more frequent testing, inspection, and maintenance. In these situations, any special testing, inspection, and maintenance procedures and schedules will be outlined in the project work plan documents and/or the site-specific QAPP Addendum or project-specific QAPP.

Any field or laboratory instrument that is in disrepair or is out of calibration must be segregated, clearly marked, and not used until it is repaired and recalibrated. If an instrument is repeatedly broken or out of calibration, the instrument must be replaced or repaired so that it is in good working order. When the condition of an instrument is suspect, unscheduled testing, inspection, and maintenance must always be conducted. Adherence to these field and laboratory preventive maintenance practices is subject to verification during performance and system audits.

3.6.2 Field Equipment and Instruments

The contractor is responsible for (1) thoroughly checking and calibrating each instrument before shipment to the field and (2) including instructions for field calibration, testing, and maintenance of each instrument shipped. Once in the field, the contractor field team leaders assume responsibility for testing, inspection, and maintenance of field instruments and equipment.

Field equipment and instruments will be inspected for damage after arrival in the field. Damaged equipment and instruments will be immediately replaced or repaired. Battery-operated equipment is checked to assure full operating capacity; if needed, batteries are recharged or replaced. Critical spare parts such as tape, paper, pH probes, electrodes, batteries, and battery chargers will be kept on site to minimize equipment downtime. Backup instruments, equipment, and additional spare parts will be available on site or within a 1-day shipping period to avoid delays in the field schedule.

Following use, field equipment will be properly decontaminated prior to being returned to its source. When the equipment is returned, copies of any field notes regarding equipment problems will be included so that problems are not overlooked and any necessary equipment repairs are carried out.

3.6.3 Laboratory Instruments

All laboratories conducting analyses of samples collected under the contract are required to have a preventative maintenance program covering testing, inspection, and maintenance procedures and schedule for each measurement system and required support activity. This program is usually documented in the form of SOPs for each analytical instrument to be used. The basic requirements and components of such a program include the following:

- Each laboratory will have, as a part of its QA/QC program, a routine preventive maintenance program conducted to minimize the occurrence of instrument failure and other system malfunction.
- Service and repair of instruments, equipment, tools, gauges, and so forth will be performed by an internal group of qualified personnel. Alternatively, scheduled instrument maintenance and emergency repair may be provided by manufacturers' representatives under a repair and maintenance contract.
- Instrument maintenance will be carried out by the laboratory on a regularly scheduled basis. The servicing of critical items should be scheduled to minimize the downtime of the measurement system. A list of critical spare parts for each instrument will be identified by the laboratory and requested from the manufacturer. These spare parts will be stored at the laboratory for availability and use to reduce downtime. The availability of spare parts will be monitored periodically.
- Testing, inspection, and maintenance procedures described in laboratory SOPs will be in accordance with manufacturer's specifications and with the requirements of the specific analytical methods employed.
- All maintenance and service must be documented in service logbooks to provide a history of maintenance records. A separate service logbook should be kept for each instrument. All maintenance records will be traceable to the specific instrument, equipment, tool, or gauge.
- Records produced as a result of testing, inspection, or maintenance of laboratory instruments will be maintained and filed at the laboratory. These records will be available for review by internal and external laboratory system audits under the contract.

3.7 Instrument and Equipment Calibration and Frequency

Instruments will be calibrated according to manufactures specifications. Field instruments will be calibrated prior to each sampling event or as instructed by the manufacturer. Field instruments include but not limited to temperature, pH and conductivity meter, and photo ionization detector.

This section describes the procedures for maintaining the accuracy of field equipment and laboratory instruments used for field tests and laboratory analyses. The equipment and instruments should be calibrated before each use or on a scheduled, periodic basis when not in use.

3.7.1 Field Equipment

Equipment used to collect field samples or take field measurements under the contract will be maintained and calibrated with sufficient frequency and in such a manner that the accuracy and reproducibility of results are consistent with the manufacturer's specifications and with project-specific DQOs.

The contractor field team leader is to verify that field sampling and measurement equipment is in good working condition. The manufacturer's operating manual and instructions that accompany the equipment will be consulted to ensure that all calibration procedures are followed.

Field measurements will vary according to project requirements. Project work plans and/or QA/QC documents will identify the types of field equipment to be used, identify the equipment requiring calibration, and include SOPs covering equipment calibration procedures, requirements for calibration standards and apparatus, calibration frequencies, and requirements for maintaining calibration records and traceability. The project work plan and/or QA/QC documents will also discuss any unique, project-specific calibration requirements.

3.7.2 Laboratory Instruments

All laboratory equipment used to analyze samples collected under the contract will be calibrated based upon written SOPs maintained by the laboratory. Calibration records (including the dates and times calibration and the names of the personnel performing the calibration) will be filed at the location where the analytical work is performed and maintained by the laboratory personnel performing QC activities. Calibration records will be subject to QA audits. Most laboratory work under the contract will be conducted by subcontractor laboratories. In all cases, the laboratory subcontractor QA manager is responsible for ensuring that all laboratory instruments are calibrated in accordance with the requirements in this Generic QAPP and in any site-specific QAPP Addendum or project-specific QAPP.

Because laboratory analytical methods will vary with each project, specific calibration procedures cannot be addressed in this Generic QAPP. However, the project work plan with site-specific R7 QAPP Addendum Form will reference the method's calibration procedures and requirements for all laboratory measurements. Calibration procedures and requirements will also be provided as appropriate for laboratory support equipment such as balances, mercury thermometers, pH meters, and other equipment used to make chemical and physical measurements.

When analyses are conducted in accordance with SW-846 methods, calibration procedures and frequencies specified in the relevant method should be followed as closely as possible. The site-/project-specific QA/QC documents should provide any additional calibration requirements (such as equipment requiring calibration, calibration procedures, requirements for calibration standards and apparatus, requirements for maintaining calibration records and traceability, calibration frequency, acceptance criteria, number of calibration points, and internal or external standards) that deviate from or are not

specified in the published EPA-approved method. Such deviations will be outlined in the site-/project-specific QA/QC documents or in an appendix as part of a laboratory SOP.

For analytical methods that are not EPA-approved, a complete SOP including the calibration procedures for the method will be included as an appendix to the appropriate project QA/QC document. Laboratory SOPs describing calibration procedures for such non-standard methods should include the following information:

- Detailed calibration procedure for each instrument used.
- Internal standard or external standard calibration requirements and procedures.
- Calibration requirements for confirmatory results (second column, second detector, mass spectral confirmation, and so forth).
- Frequency of calibration and continuing calibration checks.
- Number of calibration standards used, concentrations, and preparation methods.
- Traceability of calibration standards and continuing calibration check standards.
- Numerical acceptance criteria for initial calibration and continuing calibration checks.
- Corrective action procedures for situations where calibration procedures are not performed properly or calibration acceptance criteria are not met.
- Instructions for recording calibration information and results, including what information is to be recorded and where it is recorded and stored.

3.8 Inspection and Acceptance Requirements for Supplies and Consumables

Contractor's Project Managers have primary responsibility for identifying the types and quantities of supplies and consumables needed for environmental data collection projects conducted under the contract. Contractor's Project Managers are also responsible for determining acceptance criteria for these items. The contractor's Project Manager will ensure that any required certification is in place and document this in the field notebook and in the report prepared for EPA.

Supplies and consumables can be received either at a contractor office or at a site. When supplies are received at a contractor office, the contractor project manager or contractor field team leader will sort the supplies according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before the supplies are accepted for use on a project. If the supplies do not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order. In addition, a form will be completed describing the problem and circumstances in full, and noting the purchase order number for the item. The item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar to those described above. Upon receipt, items will be inspected by the contractor's Project Manager or field team leader against the acceptance criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

3.9 Non-Direct Measurements (Data Acquisition) Requirements

Previous investigations and sampling data acquired by EPA, State Environmental Agencies, other Federal Agencies or its contractor were all subject to Quality Assurance Project Plans and other quality controls. This information was used to select the sites for the site assessment activities for which this Generic QAPP was prepared. Previously acquired sampling data will be included in the site assessment reports, as well as the source of this data.

Some work conducted under the contract may not involve direct measurement. This includes activities that use data drawn from other sources such as databases, spreadsheets, and literature files. When such data is of critical importance in supporting sampling and analytical measurements, QA requirements for the non-direct measurement will be outlined in the project work plan with SAP and site-specific QAPP Addendum or project-specific QAPP. The source and quality of the data, along with potential problems affecting its applicability or limitations, will be documented. Such data will be reviewed for quality and supporting documentation. If supporting documentation does not accompany the data, a records or file search will be conducted to obtain the supporting documentation. Supporting documentation will be used in part to evaluate the quality and usefulness of the data. For example, if historical sampling data are to be used for an activity, the data should be reviewed to determine the QA procedures that were implemented. If such information is not available, the use of the data will be limited. Generally, data that are not supported by documentation of acceptable procedures cannot be used for enforcement purposes but may be useful for preliminary analysis and assessment. In all cases, evaluation and verification procedures for non-direct measurement data should be approved by the contractor's Quality Assurance Manager or his designee.

When a large external data set is used, computer-assisted data screening will be applied to determine the internal consistency of the data set. The goal of such screening is to identify outliers from the overall data set. When data accuracy is primarily an issue of transcription accuracy, such as keying large data sets into a computer file, proof readers will perform checks independent of the computer-assisted data screening.

3.10 Data Management Requirements

The following paragraphs provide general discussion and requirements for managing data under the contract for EPA. Further detail and requirements will be provided as necessary in the site-/project-specific QA/QC documents, including requirements for data recording, validation, transformation, transmittal, reduction, analysis, tracking, storage, and retrieval. The site-/project-specific QA/QC documents will also provide, as necessary, checklists and standard forms for detecting and correcting errors and preventing the loss of data during data reduction, data reporting, data encoding, and data entry.

Data for the contract will be obtained from a combination of sources, including field measurements and analyses, and subcontractor laboratories. The process of data gathering is a coordination effort and will be conducted by project staff in conjunction with all potential data producers. The data itself will be obtained from the analytical service provider, when appropriate, in the form of an electronic data deliverable in addition to the required hard copy analytical data package. The standard data management software of all analytical data to be submitted electronically by the contractor is SCRIBE. A hardcopy of the data will also be required as part of the site assessment report. The EPA Project Manager will review the data to ensure accuracy prior to placing into the facility file.

Data tracking is imperative to ensure timely, cost-effective, and high-quality results. Data tracking begins with sample chain-of-custody. When the analytical services provider receives the samples into custody, the provider will send a sample acknowledgment to the contractor. The sample acknowledgment will confirm the sample receipt, condition, and the required analyses.

Unless otherwise directed by EPA, the contractor will validate all data generated under the contract as described in Section 5.2 of this Generic QAPP. As a part of the data validation process, the electronic data deliverables will be reviewed against the hard copy deliverables to ensure accurate transfer of data. In addition, the hard copy will be evaluated for errors in calculation of results. As a result of the data validation, qualifiers will be placed on the data to indicate the data usability. These qualifiers will be placed into the electronic data file. Upon approval of the data set with the appropriate data qualifiers, the

electronic data will be released to the project leader for reporting. A complete discussion of data validation procedures is contained in Sections 5.1 and 5.2 of this Generic QAPP.
Following data validation and release of data, the contractor project managers will use data to prepare project reports. As a part of the final report quality control review procedures, the data will be further checked by technical reviewers and a Quality Control Coordinator (QCC) to verify its accuracy in the report.

In addition to the final report, all analytical data in the form obtained from the analytical services provider will be archived with the final project file in a secure location. The secure location will house all final project files until they are transferred to EPA.

4.0 ASSESSMENT AND OVERSIGHT

This section of the Generic QAPP includes the two QAPP elements required by EPA QA/R-5 (EPA, 2002a) to assess and evaluate the management of environmental data collection operations. These QAPP elements provide procedures for conducting appropriate audits and reports and implementing corrective actions as necessary to ensure that the quality of data generated by implementation of this Generic QAPP is adequate. The two QAPP elements related to assessment and oversight are:

- Assessment and response actions (Section 4.1).
- Reports to management (Section 4.2).

4.1 Assessment and Response Actions

The EPA Regional Quality Assurance Manager and Project Managers will evaluate the process and quality of performance on a site-by-site basis. All measured parameters will be observed to ensure that the data meets the QA/QC requirements and other site-specific requirements identified in the TO or PR and/or project work plan documents. Every attempt will be made to subcontract analytical work to a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory. If a non-NELAP certified commercial laboratory is used, assessment and response of the analytical phases will be in accordance with that laboratory's internal QA procedures. When a non-NELAP laboratory is used, deviations to EPA SOP 2440.05C will be documented in the site-specific QAPP Addendum or project-specific QAPP. The contractors/subcontractors will provide copies of the SOPs for the mobile and fixed laboratory, as part of the contractual agreements and conditions of this Generic QAPP, before providing any actual site assessment sampling services.

The EPA Project Manager may periodically visit the site to observe the field activities and determine whether field personnel are following the project work plan with SAP, the site-specific QAPP Addendum or project-specific QAPP, and SOPs, and to take corrective action if necessary. This should be documented in the field report as well as the site assessment reports. The program Generic QAPP will be revised if necessary, to ensure that program and appropriate QA/QC objectives and requirements are being achieved.

Under the contract, performance and system audits of both field and laboratory activities may be conducted to verify that sampling and analysis are performed in accordance with the procedures and requirements established in this Generic QAPP, project work plans, site-specific QAPP Addendum or project-specific QAPP. Non-conforming items identified during an audit will be addressed by corrective action. This section addresses basic audit and corrective action requirements that apply to all work conducted by the contractor under the contract. If additional project-specific audits are required by a TO or PR, they will be identified in the site-specific QAPP Addendum or project-specific QAPP.

4.1.1 Performance and System Audits

Both internal performance and system audits may be conducted on the contractor's field operations and subcontractor laboratories under the contract. Performance audits include verification that field sampling activities and measurements and laboratory analyses of performance evaluation samples are being conducted in accordance with the requirements of this Generic QAPP and any site-specific QAPP Addendum or project-specific QAPP. System audits involve a qualitative examination of all components of an environmental data collection system, including records, personnel, and QA management activities.

This section describes the selection of audit personnel, the scope of field and laboratory audits, audit frequencies, and typical audit reports for internal audits initiated by contractor's Quality Assurance Manager. External performance and system audits initiated by EPA may also be conducted under the contract and would involve similar activities.

4.1.1.1 Audit Personnel

All auditors must be independent of the activities being audited. The contractor's Quality Assurance Manager has the lead role in directing all internal audit activities during an investigation. The contractor's Quality Assurance Manager will select the appropriate personnel to conduct each internal audit and will assign them responsibilities and deadlines for completing their audits. These personnel may include the contractor's Quality Assurance Manager, or other independent auditors. When an audit team is required, the contractor's Quality Assurance Manager selects a lead auditor based on relevant technical expertise and audit experience. The lead auditor is responsible for selecting and preparing the audit team; preparing an audit plan; coordinating and scheduling the audit with the project team, subcontractor, or other organization being audited; participating in the audit; coordinating the preparation and issuance of audit reports and corrective action request forms; and evaluating audit responses and resulting corrective actions.

4.1.1.2 Audit Scope of Work

Performance audits of field activities will be conducted to evaluate compliance with the requirements of this Generic QAPP, site-specific QAPP Addendum or project-specific QAPP, and any applicable work plan/SAP with R7 QAPP Addendum Form, and SOP documents. Field systems audits may include an examination of the following items:

- Sample collection records.
- Sample collection, handling, preservation, packaging, shipping, and custody records.
- Equipment operation, maintenance, and calibration records.

Laboratory performance audits include analysis of blind performance evaluation samples to assess a laboratory's ability to comply with QC control limits. Laboratory systems audits may include evaluation of the following:

- Sample log-in, identification, storage, tracking, and custody procedures.
- Sample and standards preparation procedures.
- Availability of analytical instruments.
- Analytical instrument operation, maintenance, and calibration records.
- Laboratory security procedures.
- Qualifications of analysts.
- Case file organization and data handling procedures.

4.1.1.3 Audit Frequencies

As necessary, the site-/project-specific QA/QC documents will provide a schedule of all planned audits that will be conducted during the investigation. These audits may be required by EPA or planned by the contractor's Quality Assurance Manager. Audit frequency will depend on several factors. In selecting projects for auditing, the contractor's Quality Assurance Manager will consider projects with a large volume of work or those on which EPA has placed a high level of importance. The contractor's Quality Assurance Manager may also randomly select projects for auditing. For laboratory audits, the contractor's Quality Assurance Manager will focus on laboratories performing critical measurements (as determined by DQOs) and on subcontractor laboratories performing work for the first time.

Unscheduled follow-up audits may occur if any deficiencies are discovered during an audit or review. Follow-up audits serve to ensure that all necessary corrective actions have been properly implemented to address deficiencies.

4.1.1.4 Audit Reports

Audit reports will be prepared for performance and system audits of field and laboratory activities and all laboratory performance evaluation studies that are conducted under the contract. Reports will be prepared by the lead auditor responsible for coordinating the audit. Audit reports will identify audit participants, describe the activity audited, summarize audit findings, and detail any deficiencies or deviations from protocol that were discovered during the audits, as well as any corrective actions that are proposed. Any field or laboratory analytical data that is generated during the analysis of blind performance evaluation samples must be validated. The validated data will be included with the audit report. Data validation procedures are discussed in Section 5.2.

Audit reports are distributed to the contractor's Quality Assurance Manager, Contractor Administrator, contractor's Project Manager, and the Field Team Leader or the laboratory subcontractor's Quality Assurance Manager, as appropriate. The lead auditor has primary responsibility for ensuring that audits are conducted thoroughly and properly. Contractor's Project Managers and team field or laboratory subcontractor's Quality Assurance Manager are responsible for implementing corrective actions that result from an audit. The contractor's Quality Assurance Manager is responsible for verifying that recommended corrective actions have been implemented.

4.1.2 Corrective Action

Rapid and thorough correction of QA problems, through an effective corrective action program, minimizes the possibility of questionable data or documentation. The two types of corrective action are immediate and long-term. Immediate corrective actions include correcting procedures, repairing instruments that are working improperly, and correcting errors or deficiencies in documentation. Long-term corrective actions eliminate the sources of problems by correcting systematic errors in sampling and analytical procedures, replacing procedures that produce questionable results, and manipulating similar cause-and-effect relationships.

All QA problems and corrective actions applied are documented to provide a complete record of QA activities. These records assist the contract administrator management team in identifying long-term QA problems and enable application of long-term corrective actions such as personnel training, replacement of instruments, and improvement of sampling and analytical procedures.

The contractor's Quality Assurance Manager has the authority to discontinue or limit environmental data measurements that are compromised until corrective action is complete and data quality is no longer questionable. The contractor's Quality Assurance Manager may also order the recollection or reanalysis of samples or re-measurement of field parameters since the last documented evidence that the measurement system was in control.

Specific corrective action procedures for sample collection and field measurements and laboratory analyses are discussed below.

4.1.2.1 Sample Collection and Field Measurements

Technical staff and project personnel involved in sample collection or field measurement activities are responsible for initiating routine corrective actions by reporting all suspected technical or QA nonconformance's and deficiencies to the contractor project manager or his/her designee. Corrective actions for sample collection and field measurements may include, but are not limited to, the following:

- Repeating measurements to check for error.
- Checking that instruments are properly adjusted for ambient conditions such as temperature.
- Checking batteries.
- Checking calibration and recalibrating equipment if necessary.
- Replacing the instrument or measurement devices.
- Collecting additional samples.
- Stopping work (if necessary).

4.1.2.2 Laboratory Analyses

Each laboratory that participates as a subcontractor is required to write a SOP summarizing procedures for initiating, developing, approving, implementing, and documenting corrective action. The existence of such a program does not exempt the laboratory from following the corrective action requirements outlined in this Generic QAPP or in any site-specific QAPP Addendum or project-specific QAPP. When errors, deficiencies, or out-of-control situations arise, systematic corrective actions must be taken to resolve problems and restore proper functioning analytical systems. Laboratory personnel and Quality Assurance Managers are alerted that corrective actions may be necessary if any of the following situations arise:

- Sample volumes are not sufficient to perform required analyses.
- QC data are outside the acceptable limits for precision and accuracy.
- Blanks contain contaminants above acceptable levels.
- Undesirable trends are detected in spike recoveries or in the RPD between duplicates.
- Unusual changes in detection limits arise.
- Deficiencies are detected during internal or external audits or from the results of performance evaluation samples.
- Inquiries concerning data quality are received from clients.

If sample volumes are insufficient to complete the required analyses, the laboratory will notify the contractor project manager. The contractor's Project Manager, contractor's Quality Assurance Manager, and laboratory subcontractor's Quality Assurance Manager will contact the EPA Project Manager to determine if additional samples need to be collected.

Laboratory corrective action procedures are often initiated at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors; checks the instrument calibration; checks the

spiking levels, calibration solutions, and standards; and checks instrument sensitivity. If the problem persists or cannot be identified, the matter may be referred to the laboratory supervisor, Project Manager, or Quality Assurance Manager for further investigation. Every effort must be made to determine the cause of the problem so that a permanent solution can be developed and implemented. Once a problem is resolved, full documentation of the corrective action procedure is filed with the project records.

Investigations initiated by laboratory technical or Quality Assurance personnel that result in corrective actions must be documented and reported to the contractor's Quality Assurance Manager. Documentation of investigations of negative performance on performance evaluation samples and corrective actions taken will be forwarded to the appropriate certifying agencies when required.

4.2 Reports to Management

A draft report for Superfund's SA, ISA, RSE or RI projects will be prepared by the EPA contractor at the completion of the field sampling effort and upon receipt of validated laboratory data. The report will inform the EPA Project Manager of the status of the project; results of performance evaluations and system audits; results of periodic data quality assessments; and significant quality assurance problems and recommended solutions.

Following review by the EPA Project Manager, the EPA contractor will prepare a final report to be incorporated into the SA, ISA, RSE or RI reports for submission to EPA Region 7, as appropriate.

Effective management of environmental data collection operations requires timely assessment and review of measurement activities. Open communication, interaction, and feedback must also occur among all project participants, including contractor's corporate Quality Assurance Manager, the EPA Quality Assurance Manager or a designated representative, contractor's Contract Administrator, contractor's Project Manager, contractor's Quality Assurance Manager, technical staff, and team subcontractors.

5.0 DATA VALIDATION AND USABILITY

This section of the Generic QAPP includes the three QAPP elements required by EPA QA/R-5 (2001a) to ensure that data is valid and usable for its intended purpose. The three QAPP elements related to data validation and usability are:

- Data review, verification, and validation requirements (Section 5.1).
- Validation and verification methods (Section 5.2).
- Reconciliation with data user requirements (data quality objectives) (Section 5.3).

5.1 Data Review, Verification, and Validation Requirements

Data review and verification will be performed by a qualified laboratory analyst as described in the mobile and fixed laboratory SOPs (as described in Sections 3.0 and 4.0 above). The SOPs from the mobile and fixed laboratories will be added as an addendum to the QAPP. The EPA Project Manager will be responsible for the validation and final approval of the data (including field notes) in accordance with the stated project purpose and use of the data. Any anomalies will be documented with corrective actions described and included in the site assessment report.

This section focuses on data review and reduction requirements for work conducted under the contract. Data validation and verification requirements are covered in Section 5.2.

Data reduction and review are essential functions for preparing data that can be effectively used to support project decisions and DQOs. These functions must be performed accurately and according to EPA-approved procedures and techniques and region-specific guidelines (ESDOQAM). Data reduction includes all computations and data manipulations that produce the final results used during the investigation. Data review includes all procedures conducted by field or laboratory personnel to ensure that measurement results are correct and acceptable relative to QA objectives in this Generic QAPP and in any site-specific QAPP Addendum or project-specific QAPP.

Because the types of field measurements and laboratory measurements used will vary with each site investigation, most data reduction and review procedures and requirements cannot be addressed directly in this Generic QAPP. However, many field and laboratory measurement data reduction and review procedures and requirements are specified in field and laboratory methods, SOPs, and guidance documents. In most cases, data review and reduction procedures can be identified in the site-/project-specific QA/QC documents or in a site-specific QAPP Addendum or project-specific QAPP by referencing these sources. However, if data review and reduction are not adequately described in these sources, the site-/project-specific QA/QC documents or the site-specific QAPP Addendum or project-specific QAPP should include the following information:

- Outlined data review and reduction procedures for all phases of sample preparation and analysis (including procedures for data that are reduced and stored on computer).
- Field personnel and laboratory personnel responsible for conducting each phase of data review and reduction.
- All formulas and equations used during data reduction, including all equations used to produce final results.
- The definitions of all terms and parameters.
- The units for all parameters and results.
- Instructions on how the results from QC samples (such as blanks) will be treated and used in calculating the final results.
- Procedures for flagging, qualifying, or marking the data with labels.
- Corrective action procedures for instances when data reduction procedures are not followed correctly or when errors are found during data review.

Field personnel will record all raw data from chemical and physical field measurements in a field logbook. Contractor's Project Managers have primary responsibility for (1) verifying that field measurements were made correctly, (2) confirming that sample collection and handling procedures specified in the site-/project-specific QA/QC documents were followed, and (3) ensuring that all field data reduction and review procedures and requirements are followed. They are also responsible for assessing preliminary data quality and for advising the data user of any potential QA/QC problems with field data. When field data are used in a project report, data reduction methods will be fully documented in the report.

Each laboratory subcontractor will complete data reduction for chemical and physical laboratory measurements and will complete an in-house review of all laboratory analytical results. The laboratory subcontractor's Quality Assurance Manager is responsible for ensuring that all laboratory data reduction and review procedures and requirements in this Generic QAPP and/or in the site-specific QAPP Addendum or project-specific QAPP are followed. The laboratory subcontractor's Quality Assurance Manager is also responsible for assessing data quality and for advising the contractor's Quality Assurance Manager of possible QA/QC problems with laboratory data.

5.2 Verification and Validation Methods

The data will be validated in accordance with the mobile and fixed laboratory SOPs (see above). Field notes will be compared for consistency and the EPA Project Manager will document any anomalies. The EPA Project Manager will inspect the data to provide final review and approval to ensure that the data meets the sampling requirements.

All data that are used to support activities under the contract must be valid for their intended purposes. This section outlines the basic data validation procedures that will be followed for all field and laboratory measurements. The following subsections identify personnel responsible for data validation and the general data validation process and EPA data validation guidance that will be followed.

5.2.1 Data Validation Responsibilities

The contractor's Quality Assurance Manager, or his/her designee, is responsible for validating all field and laboratory data collected under the contract. The laboratory subcontractor will also validate all laboratory data according to their own specific procedures before submitting the data to the contractor. As requested the contractor will validate all laboratory subcontractor data, unless specified otherwise in the work plan or approved by the EPA Project Manager. Data validation will be completed by one or more experienced data reviewers. When applicable, site-specific QAPPs will include the names and qualifications of data reviewers assigned to the project.

5.2.2 Data Validation Procedures

The validity of a set of data is determined by comparing the data with a predetermined set of QC limits. For investigations conducted under the contract, these QC limits will be provided or referenced in each project-specific study. Contractor data reviewers will conduct a systematic review of the data for compliance with established QC limits (for example, sensitivity, precision, and accuracy) based on spike, duplicate, and blank sample results provided by the laboratory. The data review will identify any out-of-control data points or omissions. Contractor data reviewers will evaluate laboratory data for compliance with the following:

- Method and project-specific analytical service requests.
- Holding times.
- Initial and continuing calibration acceptance criteria.
- Field, trip, and method blank acceptance criteria.
- Surrogate recovery.
- Field duplicates, MS/MSD and matrix duplicate acceptance criteria.
- Other laboratory QC criteria specified by the method and the project-specific analytical service request.
- Compound identification and quantitation.
- Overall assessment of data in accordance with project-specific objectives.

The contractor will follow the most current EPA guidelines for completing data validation:

- "Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services. Revision 2.1." U.S. EPA Region 7. Science and Ecosystem Support Division. Office of Quality Assurance. (EPA, 1999a).
- "U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review." Publication 9240.1-05-01. (EPA, 1994a).

General procedures in the EPA guidelines will be modified as necessary to fit the specific analytical method used to produce the data.

In all cases, data validation requirements will depend on DQO levels, region-specific guidelines, reporting requirements and data deliverables requested from the laboratory. Data validation requirements presented in these sections may be referenced in the work plan/SAP, or site-specific QAPP Addendum or project-specific QAPP to ensure consistency.

5.3 Reconciliation with User Requirements (Data Quality Objectives)

The EPA Project Manager, for completeness needed to achieve the project's goal, will evaluate data. If the data quality indicators do not meet the project requirements outlined in the site-specific QAPP Addendum or project-specific QAPP, the data may be discarded and re-sampling may occur. In case of a failure, the project team will evaluate the cause. If the failure is due to laboratory procedures or equipment, necessary corrective measures will be taken by the EPA Quality Assurance Manager and EPA Project Manager. If failure is associated with sampling, field procedures will be re-evaluated with any changes documented by the EPA Project Manager and included in the site assessment report.

The primary purpose of a QA system is to define a process for collecting data that is of known quality, is scientifically valid, is legally defensible, and fully supports any decisions that will be based on the data. To achieve this purpose, this Generic QAPP requires that DQOs be fully defined in Section 2.5. All other parts of the QA system must then be planned and implemented in a manner consistent with the DQOs. The QA system components that follow directly from the DQOs include documentation and reporting requirements (Section 2.8); sample network design and sampling methods (Sections 3.1 and 3.2); analytical methods requirements (Section 3.4); QC requirements (Section 3.5); and data reduction, validation, and reporting methods (Sections 5.1 and 5.2).

Once environmental data have been collected, reviewed, and validated, the data must be further evaluated to determine whether the DQOs identified in the project work plan/SAP, the site-specific QAPP Addendum, or the project-specific QAPP have been met. Contractor will follow EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. The DQA process involves first verifying that the assumptions under which the data collection design and DQOs were developed have been met, or taking appropriate corrective action if the assumptions have not been met. The DQA process then evaluates how well the data collected support the decision that must be made so that scientifically valid and meaningful conclusions can be drawn from the data. To the extent possible, Contractor will follow DQA methods and procedures outlined in EPA documents Data Quality Assessment: A Reviewer's Guide QA/G-9R (EPA, 2006c) and Data Quality Assessment: Statistical Tools for Practitioners QA/G-9S (EPA, 2006d).

If data quality indicators do not meet the project's requirements as outlined in the QAPP, the data may be discarded, and re-sampling and/or re-analysis may be required.

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APPENDICES

Appendix A

Region 7
Quality Assurance Project Plan Form

(R7 QAPP ADDENDUM FORM)

Region 7 Superfund Program
Quality Assurance Project Plan Form
Project Information:

Site Name: Cherokee County Superfund Site OU 8 (TO73)		**City:** Cherokee County (County-Wide)	**State:** Kansas
EPA Project Manager: Elizabeth Hagenmaier		**HGL Project Manager:** Andrea Fletcher	
Approved By:			
Title: HGL Project Manager	**Date:** 3/31/17	**Prepared For:** EPA Region 7 Superfund Division	
Approved By:			
Title: HGL Program Manager	**Date:** 3/31/2017		
Approved By:		**Prepared By:** Andrea Fletcher	
Title: HGL QA Manager	**Date:** 3/31/2017	**Date:** March 31, 2017	
Approved By:			
Title: EPA Project Manager	**Date:** 5/16/17		
Approved By: Diane Harris (approved w/ conditions)		**AES Contractor:** HydroGeoLogic, Inc (HGL)	
Title: EPA Superfund QA Coordinator	**Date:** 05/14/2017	**AES Contract Number:** EP-S7-05-05	

1.0 Project Management:

1.1 Distribution List

EPA--Region 7: Elizabeth Hagenmaier, EPA Project Manager
Diane Harris, Superfund QA Coordinator

AES Project Managers: Andrea Fletcher

1.2 Project/Task Organization

Elizabeth Hagenmaier, the EPA TOPO, will serve as the EPA Project Manager for activities described in this QAPP
Andrea Fletcher from HGL will serve as the Task Order Manager (TOM), the HGL Project Manager.
Personnel for soil sampling

1.3 Problem Definition/Background:

Description. This site-specific Quality Assurance Project Plan form is prepared as an addendum to the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites (June 2007)** and contains site-specific data quality objectives (Table 2) for the sampling activities described herein

☐ Problem Definition/Background Description attached
☒ Description in referenced report. Final RI Report Cherokee County Operable Unit 8 Railroads Site (Title) March 2016 (Date)

1.4 Project/Task Description:

☐ CERCLA PA ☐ CERCLA SI ☐ Brownfields Assessment
☒ **Other (description included)** ☐ Pre-CERCLIS Site Screening ☐ Removal Assessment

Schedule: Field work is tentatively scheduled for May - June 2017
☐ Description in referenced report
Title Date

1.5 Quality Objectives and Criteria for Measurement Data:

a. Accuracy ☒ Identified in attached Table 2.
b. Precision ☒ Identified in attached Table 2.
c. Representativeness: ☒ Identified in attached Table 2.
d Completeness: ☒ Identified in attached Table 2.
e. Comparability: ☒ Identified in attached Table 2.

Other Description: A completeness goal of 100 percent for the confirmation samples has been established for this project. However, if the completeness goal is not met, EPA may still be able to make site decisions based on any or all of the remaining validated data.

1.6 Special Training/Certification Requirements:

☒ OSHA 1910
☐ Special Equipment/Instrument Operator
☐ **Other (describe below):**

Region 7 Superfund Program
Quality Assurance Project Plan Form

1.7 Documentation and Records:

☒ Field Sheets	☒ Site Log	☐ Trip Report	☒ Site Maps	☐ Video
☒ Chain of Custody	☒ Health and Safety Plan	☐ Letter Report	☒ Photos	

Sample documentation will follow EPA Region 7 SOP 2420.5.

Other: Analytical information will be handled according to procedures identified in Table 2.

2.0 Measurement and Data Acquisition:

2.1 Sampling Process Design:

☐ Random Sampling	☐ Transect Sampling	☒ Biased/Judgmental Sampling	☐ Stratified Random Sampling
☐ Search Sampling	☐ Systematic Grid	☐ Systematic Random Sampling	☐ Definitive Sampling
☐ Screening w/o Definitive Confirmation		☒ Screening w/ Definitive Confirmation	

The proposed sampling scheme for soil sampling will be biased/ judgmental, with definitive laboratory analysis, in accordance with procedures included in the Guidance for Performing Site Inspections Under CERCLA, OSWER Directive #9345.1-05, September 1992, and Removal Program Representative Sampling Guidance, Volume 1: Soil, OSWER Directive 9360.4-10, November 1991. Ten percent of samples, or approximately 60 samples, will be submitted for analysis by the EPA Region 7 laboratory. The proposed number of samples is a balance between cost and coverage and represents a reasonable attempt to meet the study objectives while staying within the budget constraints of a typical site investigation.

Sample Summary Location	Matrix	# of Samples*	Analysis
Soil screening samples	Soil	600	Total lead and zinc by XRF
Soil confirmation samples	Soil	60	Total lead and zinc

*NOTE:.

2.2 Sample Methods Requirements:

Matrix	Sampling Method	EPA SOP(s)/Methods
Soil screening samples	A grab sample will be collected using hand tools from every 6-inch interval from ground surface to a depth of 4 feet at each location. A backhoe will be used to excavate soil in 6-inch lifts. Soil will be collected from the backhoe bucket and homogenized for XRF screening in a plastic bag.	EPA SW-846, Method 6200 (XRF Field Screening)
Soil confirmation	Sufficient sample volume will be collected for the screening sample so that a confirmation sample can be placed in an 8-oz jar for analysis at the Region 7 Laboratory.	EPA Region 7 SOP 4230.19

Region 7 Superfund Program
Quality Assurance Project Plan Form

2.3 Sample Handling and Custody Requirements:

☒ Samples will be packaged and preserved in accordance with procedures defined in Region 7 EPA SOP 2420.6.
☒ CoC will be maintained as directed by Region 7 EPA SOP 2420.4.
☒ Samples will be accepted according to Region 7 EPA SOP 2420.1.
☐ **Other (Describe):**

2.4 Analytical Methods Requirements:

☐ Identified in attached table.
☐ Identified in attached Analytical Services Request (ASR) Form.
☒ **Other (Describe):** Identified in future ASR Form.

2.5 Quality Control Requirements:

☐ Not Applicable
☒ Identified in attached Table 1.
☒ In accordance with the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites (April 2013).**

Describe Field QC Samples to be Collected: All QC samples will be submitted for the analyses listed in Table 1 (attached). Precision and accuracy will be evaluated based on the MS/MSD and field duplicate samples, and representativeness will be evaluated with the field duplicates. Evaluation of blank samples depends on the levels of contamination found in environmental samples to determine whether the environmental samples are representative. In compliance with the generic QAPP, RPD should be ± 25%.
☐ **Other (Describe):**

2.6. Instrument/Equipment Testing, Inspection, and Maintenance Requirements :

☐ Not Applicable
☒ In accordance with the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites (April 2013).**
☒ **Other (Describe):** Testing, inspection, and maintenance of field instruments (GPS unit, XRF unit, etc.) will be performed in accordance with manufacturers' recommendations. Testing, inspection, and maintenance of laboratory equipment will be performed in accordance with referenced SOPs and/or manufacturers' recommendations.

2.7 Instrument Calibration and Frequency:

☐ Not Applicable
☒ Inspection/acceptance requirements are in accordance with the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites (April 2013)**.
☒ Calibration of laboratory equipment will be performed as described in the referenced SOPs and/or manufacturers' recommendations.
☒ **Other (Describe):** Calibration of field instruments will be performed daily as described in the manufacturers' recommendations.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables:

☐ Not Applicable
☒ In accordance with the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites (April 2013).**
☒ All sample containers will meet EPA criteria for cleaning procedures for low-level chemical analysis. Sample containers will have Level II certifications provided by the manufacturer in accordance with precleaning criteria established by EPA in *Specifications and Guidelines for Obtaining Contaminant-Free Containers.*
☐ **Other (Describe):**

2.9 Data Acquisition Requirements:

☐ Not Applicable
☒ In accordance with the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites** (**April 2013).**
☒ Previous data/information pertaining to the site (including other analytical data, reports, photos, maps, etc., which are referenced in this QAPP) have been compiled by EPA and/or its contractor(s) from other sources. Some of that data has not been verified by EPA and/or its contractor(s); however, the information will not be used for decision-making purposes by EPA without verification by an independent professional qualified to verify such data/information.
☐ **Other (Describe):**

2.10 Data Management:

☒ All laboratory data acquired will be managed in accordance with Region 7 EPA SOP 2410.1.
☐ **Other (Describe):**

3.0 Assessment and Oversight:

3.1 Assessment and Response Actions:

☒ Peer Review ☒ Management Review ☐ Field Audit ☐ Lab Audit
☒ Assessment and response actions pertaining to analytical phases of the project are addressed in Region 7 EPA SOPs 2430.6 and 2430.12.
☐ **Other (Describe):**

3.1A Corrective Action:

☒ Corrective actions will be taken at the discretion of the EPA project manager, whenever there appear to be problems that could adversely affect data quality and/or resulting decisions affecting future response actions pertaining to the site.
☐ **Other (Describe):**

Region 7 Superfund Program
Quality Assurance Project Plan Form

3.2 Reports to Management:

☐ Audit Report ☐ Data Validation Report ☐ Project Status Report ☐ None required
☐ A letter report describing the sampling techniques, locations, problems encountered (with resolutions to those problems), and interpretation of analytical results will be prepared by HGL and submitted to EPA.
☒ Reports will be prepared in accordance with the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites** (**April 2013**).
☒ **Other (Describe):** A Preliminary Design Report will be submitted for this task order.

4.0 Data Validation and Usability:

4.1 Data Review, Validation, and Verification Requirements:

☐ Identified in attached table.
☒ Data review and verification will be performed in accordance with the **Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites** (**April 2013).**
☒ Data review and verification will be performed by a qualified analyst and the laboratory's section manager as described in Region 7 EPA SOP 2410.10.
☐ **Other (Describe):**

4.2 Validation and Verification Methods:

☐ Identified in attached table.
☒ The data will be validated in accordance with Region 7 EPA SOP2410.10.
☒ The EPA TOPO will inspect the data to provide a final review. EPA lab personnel will review the data, if applicable, for laboratory spikes and duplicates, laboratory blanks, and the field blank to ensure that they are acceptable. EPA lab personnel will also compare the sample descriptions with the field sheets for consistency and will ensure that any anomalies in the data are appropriately documented.
☐ **Other (Describe):**

4.3 Reconciliation with User Requirements:

☐ Identified in attached table
☒ If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded and re-sampling or re-analysis of the subject samples may be required by the EPA project manager.
☐ **Other (Describe):**

Table 1: Sample Summary

Site Name: Former Cherokee County OU8 | **City:** Cherokee County, Kansas

HGL Project Manager: Andrea Fletcher (TO73) | **Activity/ASR #:** TBD | **Date:** June 2017

Number of Samples	Matrix	Location	Purpose	Depth or other Descriptor	Requested Analysis	Sampling Method	Analytical Method/SOP
TO73							
Up to 600	Soil	Up to 60 locations based on rail line inventory	Assess potential contamination from construction materials in rail lines	Up to 8 samples at a 6-inch intervals vertically at each location from the surface to 4 feet bgs, and up to 4 samples horizontally at half the sample locations	Total lead and zinc	EPA SW-846, Method 6200 (XRF Field Screening) & SOP 3122.03	XRF
Up to 60	Soil	Co-located with select XRF locations	Confirm XRF screening results	0-6 inches collected at select locations	Total lead and zinc	SOP 4230.19	SW846 6010B
QC Samples							
TO73							
Up to 6	Soil	Duplicates	QC	Variable	Total lead and zinc	SOP 4230.19	SW846 6010B
Up to 6	Soil	MS/MSD	QC	Variable	Total lead and zinc	SOP 4230.19	SW846 6010B

Notes:
ASR = analytical services request
bgs = below ground surface
EPA = U.S. Environmental Protection Agency
HGL = HydroGeoLogic, Inc.
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
SOP = standard operating procedure
TBD = to be determined
TO = task order
XRF = x-ray fluorescence

Table 2: Data Quality Objectives Summary								
Site Name: Former Cherokee County OU8					**City:** Cherokee County, Kansas			
HGL Project Manager: Andrea Fletcher (TO73)					**Activity/ASR #:** TBD		**Date:** May – June 2017	
Analysis	**Analytical Method**	**Data Quality Measurements**					**Sample Handling Procedures**	**Data Management Procedures**
		Accuracy	**Precision**	**Representativeness**	**Completeness**	**Comparability**		
Soil (TO 73)								
See Table 1	See Table 1	per analytical method	per analytical method	Biased/judgmental sampling based on professional judgment of the sampling team. XRF screening with confirmation sampling	10%	Standardized procedures for sample collection and analysis will be used	See Section 3.2 of the Generic QAPP	See Section 3.10 of the Generic QAPP form

Notes:
% = percent
ASR = analytical services request
HGL = HydroGeoLogic, Inc.
OU = operable unit
QAPP = Quality Assurance Project Plan
TBD = to be determined
TO = task order
XRF = x-ray fluorescence

Table 3: EPA Approved Methods					
Matrix	**Location**	**Purpose**	**Requested Analysis**	**Sampling Methods**	**Analytical Method**
Samples					
Soil	Former Rail Beds throughout Cherokee County	Confirm XRF readings obtained in the field	Total lead and zinc	EPA SOPs 4231.1707 and 4231.2012	EPA Method 3050B/6010B
QC Samples					
Soil	Field duplicates	Assess the precision of analytical and sampling methods	Total lead and zinc	EPA SOPs 4231.1707 and 4231.2012	EPA Method 3050B/6010B

Notes:
EPA = U.S. Environmental Protection Agency
QC = quality control
SOP = standard operating procedure
XRF = x-ray fluorescence

Appendix B

Sample Collection Field Sheet

Sample Collection Field Sheet

US EPA Region 7
Lenexa, KS

ASR Number: Sample Number: QC Code: Matrix: Tag ID:

Project ID No.: EPA Project Manager:

Project Desc:

City: State:

Program:

Location Desc:

External Sample Number: _____

Expected Concentration (Circle One): Low Medium High Date:
Time(24hr):

Latitude: ___ ___ ___ Sample Collection: Start ___/___/___ ____:____
Longitude: ___ ___ ___ End ___/___/___ ____:____

Field Measurements:

Parameter	Value	Units
Conductance, Specific	_____	umhos/cm
pH	_____	SU

Laboratory Analyses:

Container Name	Preservative	Holding Time	Analysis

Sample Comments:

Sample Collected By: _____

Appendix C

Example of a Daily Quality Control Report (DQCR)

DAILY QUALITY CONTROL REPORT

Project Manager: _____

Project: _____

Date: _____

S	M	T	W	TH	F	S

Weather	Bright Sun	Clear	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85	>85
Wind	Still	Moderate	High	Gusty	
Humidity	Dry	Moderate	Humid		

Personnel on Site: _____

Contractors on Site: _____

Visitors on Site: _____

Work Performed: _____

Sheet 1 of 2

Project: _____ **Date:** _____

Quality Control Activities (including field calibration and duplicate samples collected): _____

Problems Encountered/Corrective Actions Taken: _____

Downtime/Standby: _____

Health and Safety Activities: _____

Special Notes: _____

By: _____ **Date:** _____

Sheet 2 of 2

Appendix D

Example of a Chain-of-Custody (COC) Form

SAMPLE CHAIN OF CUSTODY

Project Name: _____ **Project Location:** _____

Activity Number: _____

Project Manager: _____

Samplers: _____

Sample Date	Time	Sample Identification	Preservative	No. of Containers	Type of Containers	Analysis

Remarks/Additional or Special Analyses: _____

Signatures	Date	Time	Mode of Shipment	Reason for change of custody
Relinquished By:				
Received By:				
Relinquished By:				
Received in Laboratory By:				